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Journal of the Australian Institute of Agricultural Science

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PRESIDENTIAL ADDRESS

AUSTRALIAN WATER POLICY

A. L. TISDALL

I. Water Resources

Water is our most vital natural resource. It is as necessary to life as the air we breathe, and the food we eat. Without water, neither man, nor animal, nor plant could survive and the soil could not produce food or fibre.

The earliest civilisation arose in areas with good natural water supplies, either in high rainfall areas or on the banks of rivers, as was the case in ancient Egypt and Mesopotamia. To be assured of sufficient water has always been a major concern of mankind.

1. *Australian Resources.*

Australia is a dry continent, the greater part of which lies within the 15° to 35° latitude belt, the zone of most of the world's deserts. A vital factor is the lack of high mountains; less than 7 per cent of Australia is above 2,000 feet in elevation and very little of this is in the tropics. The mountains we do have are mainly in the south and south-east, and help to keep the interior dry, as they catch the greater part of the moisture of the south-east trade winds.

As a result, our average annual rainfall is only 18″ compared with 29″ for U.S.A., 40″ for Great Britain and 45″ for India. Only about one-third of Australia has an annual rainfall of 20″ or better, while nearly 40 per cent has less than 10″. By comparison, only 7 per cent of U.S.A. has such a low rainfall.

The rainfall we do get is very variable, and on world standards unreliable. This rainfall pattern is reflected in the river systems. No other continent has such a scarcity of rivers as Australia; perennial streams occur only in a narrow strip along the northern, eastern and south eastern coasts and in a small area in the south-west. A large area has no rivers at all, and this area actually reaches the coast in two places. About 450 miles of coast-line in the North-West, and 1,200 miles of the Great Australian Bight, are "dry".

The most important river system is in the south-east—the Murray—but compared with other catchments of the world of similar size, the Murray is a very small river indeed.

In size of catchment area, the Murray is larger than the Columbia River in the U.S.A. and the Indus in Pakistan, both of which are also used for irrigation, but the annual flows are very different. The Indus discharges roughly thirteen times, and the Columbia over sixteen times, as much water as the Murray every year.

The variability of stream flow presents an even worse picture; for example, the Murray has been almost dry on occasion, while in 1956 the flow was 44 million acre feet, or nearly four times the average annual flow. There is also a wide variation in seasonal flow in any one year.

From an irrigation point of view, this means not only that we are short of water, but also that we need a large volume of storage for each irrigated acre.

Again some comparisons are helpful in getting Australian irrigation into the right perspective. If we compare the amount of storage necessary to ensure supplies to one acre of land, we find that Australia has over 5 acre feet of storage of every acre irrigated. The U.S.A. has roughly half this figure, Egypt a quarter and India less than one-tenth.

2. *Assessment of Resources*

The first consideration, then, is to assess what resources we have available. Many of our stream gauging records in Australia were started last century and have been maintained ever since, and, together with a knowledge of climatology, give us a working knowledge of our surface resources.

Every generation sees more great water projects developed—projects which were

simply not possible to an earlier generation—and no doubt more will be possible to future generations. Naturally, the best dam-sites on the rivers and the least costly projects were developed first, and each subsequent scheme is more costly per acre foot of water supplied for irrigation.

In the future our ground-water resources will need to be tapped in increasing amounts as surface waters are harnessed and utilized. Our knowledge of ground-water resources in Australia is by no means complete, although we do know that much of it is too saline for irrigation. Eventually these resources will have to be more thoroughly explored; in fact, a start has already been made on this work.

3. *Stages in Conservation*

In any country the first stage in water conservation is the utilisation of natural flows by diversion from streams. This was the method used in the early days of irrigation in the United States and also in Australia.

Many of these diversion schemes are still operating; for instance, the Goulburn Weir is still used for diversion of the waters of the Goulburn River in Victoria. Of course, the flow is now controlled and supplemented from the Eildon Storage, but in the 'eighties the water was simply diverted by locally elected Irrigation Trusts.

Over the next twenty years Australia slowly evolved water laws which are now based on the broad principle that the water in all streams is public property, and controlled by Government so that it can be distributed equitably among water users. This policy has worked well in practice; for example, in Victoria there has been no litigation with regard to rights to water for over fifty years.

This compares more than favourably with the position in the United States, where litigation over rights to water is very common, and has been very costly over the years.

It is worth mentioning that the only control over underground water in Australia is in the artesian bore areas in Queensland, but as our demand for water increases, further State control will be necessary. The time must come when an individual will not be allowed to deplete an underground aquifer or reservoir, at the expense of his neighbours. As well as in Queensland, this position has already arisen in Arizona and California in U.S.A., and in the London Artesian Basin in England, where legislation was introduced in 1945.

As development proceeds, the second stage of conservation is reached; this involves the storage of winter flow in the rivers for use in the following summer. This is the basis of "water harvesting" on private properties, and also of many irrigation schemes in Australia.

The third stage in development is the storage of river flow in wet years for use in subsequent dry years, involving the construction of carry-over storages, which must be big enough to "iron out" variations over a dry cycle of several years and so safeguard perennial crops. This concept implies a very strict control of the water used each year. The demand for irrigation water these days is enormous, but if the supplies for a dry season are to be assured, there must be some limit to the supplies in average years. The setting of these limits is one of the most difficult tasks of an irrigation authority.

The fourth method of conservation is to reduce water losses, to make our distribution as efficient as possible, and so to use the available water to give maximum production. This is not necessarily the final stage; it may come anywhere in the sequence of development, depending on economic factors.

In the early stages it may be cheaper to store additional water than to reduce losses, but eventually all stages of water conservation will be necessary in Australia.

II. History of Conservation

1. *Water Supply*

The history of water supply in Australia commenced in Victoria after the droughts of 1877 and 1881, when it became recognized that the northern plains could be developed only with water artificially supplied, and the Government began the systematic regulation of north-flowing streams. The Chaffey Brothers, who were successful irrigationists in California, were invited to investigate the possibilities of the Murray River from Echuca to Renmark.

In 1886 they established irrigation settlements at Mildura, Victoria and at Renmark,

South Australia and although these settlements went through difficult periods, they are now thriving. These schemes were among the earliest in the world involving high lift pumping on a large scale.

The Irrigation Act passed by the Victorian Government in 1886 influenced the whole future of development of water resources in Australia, as it established the revolutionary principles on which subsequent development was based. This Act vested in the Government the right to the use of water in any stream, lake or swamp, and stipulated that no riparian rights could be established which might prevent irrigation or other water use.

By 1899 there were nearly 90 Irrigation and Waterworks Trusts operating in Victoria, but progress had been much faster on the engineering side than that of the landowners, and when an attempt was made to collect the necessary revenue to meet interest on the cost of works, the whole system of local management broke down. In that year, 1899, a relief Act was passed, writing off three-quarters of the existing liabilities of the Trusts.

In 1905, the Victorian Government passed the Water Act, which consolidated all previous water law, abolished all the Trusts except Mildura, provided for the apportionment of water rights to lands in irrigation districts and set up the State Rivers and Water Supply Commission as an authority to control all rural water supplies. It also declared that the bed and banks of all streams should become and remain the property of the Crown, thus completing finally the nationalisation of streams and other natural sources of water supply commenced by the Irrigation Act of 1886. Legislation followed parallel lines in other States, and thus the nationalisation of the water resources of the Commonwealth was virtually completed quite early in our history.

Irrigation upsets the hydrologic balance of an area, and to reach a new equilibrium most such areas sooner or later need a comprehensive drainage scheme. Drainage is therefore a necessary adjunct to irrigation development, and should be regarded as an inevitable part of the development cost. It is, however, rather a vast subject in its own right and will not be considered further here.

Urban water supplies have developed in parallel with irrigation and rural domestic and stock supplies. It is an axiom in water supply administration that domestic supplies must take precedence over all other uses. With the rapid development of secondary industry in this country, the demand for industrial water is increasing spectacularly. In many cases industrial uses do not demand a very pure water, and as total water resources become more taxed in the future, it may be necessary to prohibit the use of potable water for industrial use where a non-potable supply would fulfil the requirement and can be substituted. An example is the increasing use of water in cooling systems, such as are associated with power generation or with air conditioning. Such industrial plants will have to consider the use of sea water or a recirculation system.

A case in point is the new Hinkley Point Nuclear Power Station in England, which will use cooling water continuously at the rate of 1500 cusecs—the capacity of a major irrigation canal in Australia. All this water is for one power station; naturally it will have to use sea water rather than fresh water.

Urban water supplies are in total quantity much smaller than irrigation requirements, but the provision of piped supplies is costly and the systems have to be ever extended and enlarged to cope with expanding populations.

There is an economic limit to the distance water can be piped, even for domestic use. Perhaps the most spectacular scheme of this type is the pipeline to the Western Australian goldfields and towns along the way. Here water is carried nearly four hundred miles to serve Kalgoorlie, which would otherwise be practically uninhabitable and its gold inaccessible, and the scheme has been successfully maintained for nearly sixty years. It is worth noting, however, that the operation costs are many times the costs usually contemplated for a city water supply.

Possible methods of desalting of water are receiving a great deal of publicity these days. Costs are still far too high even for domestic water supplies except in isolated cases. They

will no doubt fall as technical knowledge advances, but it is important to remember that these costs are *in addition* to reticulation costs, and not an alternative.

When considering the desalting of sea water, it is as well to realise that even if the sea were fresh, the present cost of conveying water by pipelines would preclude its use at any appreciable distance from the coast except in very special circumstances.

Pumping costs would be additional to capital costs for pipeline installations. For instance, considering the difference in level only, a rough calculation shows that it would cost £15 per acre foot to pump sea water to the same elevation as the outlet from Eildon Reservoir. By contrast, the present annual cost of Eildon water is about £1 an acre foot of output from storage.

Sewerage could be regarded as an adjunct to urban water supply just as drainage is to irrigation. Sewerage construction in Australia has also expanded rapidly since the war, but still lags behind water supply. As an amenity it tends to be treated as a lower priority than water supply.

2. *Soil Conservation*

The last thirty years have seen the development of soil conservation as a State responsibility. Good soil conservation generally means optimum water conservation, but unwise land use can lead to soil erosion, which may be accompanied by water-logging and salting of part of the landscape.

In this work progress has been much greater in recent years following the use of the ecological approach to conservation. We now try to understand the causes of soil deterioration due to changes in environment induced by man. This is followed by planning of conservation programmes for farms, for subsidiary catchments and finally for whole catchments. Examples of this type of planning that come to mind are found in the Hunter Catchment in N.S.W. and the Campaspe Catchment in Victoria.

All Australian States now have some form of soil conservation authority and the work of such bodies has to be co-ordinated with that of all other authorities concerned with conservation of forest, land, and water resources. In Victoria, this is achieved by the Land Utilization Advisory Council, which consists of the heads of all departments concerned and advises on conservation policy.

III. Federal Water Policy

There are unmistakable signs that a Federal water policy is being developed in Australia, just as the past eighty odd years have seen the evolution of State water policies.

The first consideration has inevitably come in the use of water supplies within catchments which extend across State boundaries, and so interstate agreements have been necessary.

1. *River Murray Agreement*

The Murray River and its tributaries form the largest river system in Australia. The catchment covers 414,000 sq. miles, about one seventh of the area of the Australian continent, comprising five sixths of N.S.W., over one half of Victoria, a small portion of South Australia and an area of Queensland which exceeds the total area of Victoria.

Discovered in 1824, the Murray played a substantial part in early pastoral settlement. Navigation was the predominant initial interest, providing cheap transport of supplies and produce. Irrigation settlements which developed after 1886 commenced a new era and in 1902 the first steps were taken to co-ordinate the utilization of its waters. Final agreement was reached in 1914, when the three States concerned, New South Wales, Victoria and South Australia, recognized that joint control was necessary. The following year they co-operated with the Commonwealth in establishing the River Murray Agreement, which provided for the allocation of water between the three States and the construction of dams, weirs, locks and storages to control this allocation, and for equal financial contributions from these four Governments to meet the capital cost.

The agreement has been modified several times by Commonwealth and State legislation to allow for further development, which is still going on. Control of the waters of the Murray and maintenance of the water supply works are

now vested in the River Murray Commission, which has representation from the Commonwealth and the three States concerned.

2. *New South Wales Queensland Border Agreement*

The Border Streams Agreement, effective from 1947, provided for the construction of works on the Barwon, McIntyre and Dumaresq Rivers, forming part of the boundaries between the two States, on the basis of equal partnership in both expenditure and use of water.

3. *Snowy Mountains Scheme*

Comprehensive investigations into both water and power potential of the Snowy River waters culminated in 1949 in the Commonwealth setting up an Authority to implement the proposals agreed to. The basic idea is to impound the Snowy River waters at high elevations, and, by diverting them in a westerly direction, to generate electric power and then discharge them into the Murrumbidgee and Murray Rivers for irrigation use.

Construction of this vast scheme, which will take some ten to fifteen years to complete, is in the hands of the Snowy Mountains Hydro-electric Authority, but the policy, including control of power generation and water distribution, is the province of the Snowy Mountains Advisory Council, on which the Commonwealth, and the water and electricity supply authorities of the two States concerned, are represented.

4. *Co-ordination of Water Research*

Several avenues for integration of research into water supply problems being carried out in the several States are now emerging.

This year will see the revival of the "Underground Water Conference of Australia"—a standing committee in which the Commonwealth and all States will participate.

In the more general field there is an annual interstate Water Resources Conference, with representatives from Government agencies interested in the subject, which advises Governments on the assessment of water resources. In conjunction with this body, the Institution of Engineers, Australia has a permanent Hydrology Committee whose annual meeting follows immediately after the Conference. Two-thirds of the personnel would be common to both organisations, and to prevent overlapping there is an understanding on the respective functions of each.

C.S.I.R.O. has also taken an interest in hydrology research and has conducted several conferences and discussion groups on the subject.

Another organisation, the Water Research Foundation of Australia Ltd. was formed in 1955 for the purpose of undertaking research in hydrology and water engineering. This is a non-profit body which sponsors and co-ordinates research on a nation-wide basis. In the last twelve months, this idea has spread rapidly and the Foundation now has active State committees in Victoria, N.S.W. and W.A., and financial support from most Australian Governments.

IV. Financial Participation

We have seen that there is a growing movement for a common Australia-wide approach to water supply problems, into which the Commonwealth has inevitably been drawn.

Works on the River Murray were financed in equal shares by the Commonwealth and the three contracting States. The authorized works are specifically covered by the River Murray Agreement and include the Hume Dam, Lake Victoria, the Murray Mouth Barrages, fourteen weirs on the Murray, and two on the Murrumbidgee.

The Commonwealth has also made some recent contributions towards the cost of water conservation and utilisation in some States. For instance, Western Australia has now designed a comprehensive water supply scheme which will further expand the type of works constructed for the gold-fields, and since expanded to adjacent rural areas. This scheme is to cost some £10,000,000, of which the Commonwealth will find half. You will all have heard of the projected development on the Ord River, for which the Commonwealth has agreed to find £2,500,000. The investigation of this scheme, in both enginering and agricultural aspects, is already being run as a joint Commonwealth-State venture.

The Snowy Mountains project has already been mentioned. The diversion of the coastal river system through the mountains, and the consequent generation of hydro-electric power are being financed by the Commonwealth. Although most, if not all, of this money is being found out of current revenue, it will earn interest from the sale of electric power to the States. The States, on the other hand, pay interest on all the money they use for the construction of water supply works.

A great deal of progress has been made in both urban reticulation and irrigation since the war, but few would contend that we have overcome the back-log accumulated during the war and at the same time kept pace with population increases and the demand for increased primary production.

We need to plan ahead both in estimates of population trends and in setting goals for primary production, for in this connection irrigation offers a sure way of increasing our production. In Victoria, which has roughly half of Australia's irrigation, the million acres which are irrigated represent only one-thirtieth of the farming lands of the State, but already produce one-sixth of the total farm production.

The Australian figure for irrigation is one-eighth of the total rural output, including everything from sheep to forest products.

Water planning is a long range business. We have already discussed stream gauging and the assessment of resources. Storage sites must be investigated hydrologically and geologically, topographical surveys must be made, and a host of engineering factors must be considered.

The problems of where and in what quantity the water is to be used, and when and how it is to be reticulated all take time to solve, and require trained personnel to solve them. And so we must plan ahead so that the projects are ready when required.

Water supply authorities are faced with limitations in money, men and materials. It is good to plan ahead, but it is no good designing so far ahead that the blueprints will be out of date before they are used, particularly as this designing ties up trained personnel who are then not available for the short-term programme. A balance must be kept between planning, designing, construction, and finally the operation and maintenance of projects as they are built. All these aspects compete for trained personnel, who as you all know are in critically short supply in Australia.

There is a tendency these days to think that finance should not be a limiting factor in public works, that money can be found for all sorts of projects. It is as well to remember that money means so many man hours of work, from the trained professional man or the unskilled labourer, and that Australia has only a limited quantity of man hours available at any one time. If they are used on one project, then they are not available for another, and so we must consider very carefully the relative importance of various projects.

It is essential that water supply projects should be regarded as a high priority in Australia, and money must be found for them at a greater rate than is being done at present. As we have seen, the present policy is that water conservation is a matter for the States, but the examples quoted show that the policy is capable of being modified. It will probably be modified further in future.

We must never lose sight of the fact that water supplies in Australia will always be limited, and that the potential demand for water will always exceed the supply.

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LUPINOSIS IN THE LIGHT OF OLD AND NEW EVIDENCE

J. HACKBARTH

The use of lupins for grazing in South Africa and Western Australia has grown considerably during the last twenty or thirty years. In South Africa the yellow lupin (*Lupinus luteus* L.) and the blue lupin (*L. angustifolius* L.) are the main species cultivated, whereas in Western Australia it is the so-called "West Australian blue lupin" (*L. digitatus* Forsk.) which has assumed greatest importance (Gladstones 1959). This species is native to the Mediterranean area, but is not cultivated there.

The early finding that lupins provided valuable summer feed for sheep, as well as being useful in building soil fertility, was the main reason for the rapid increase in their use which occurred in these countries. After a time, however, the disease lupinosis began to appear in flocks grazed on lupins, just as had occurred in Germany towards the end of the 19th century.

It might therefore be useful to trace the history of lupinosis in Germany and Central Europe generally, and to compare it with that of more recent outbreaks in other countries. Measures will be described which have been successful in overcoming the problem in Europe.

Lupin cultivation and lupinosis in Europe

The oldest agricultural species is the white lupin (*L. albus* L.), which was known to the ancient Greeks and Romans. It was introduced into Germany in the 18th century by King Frederick II of Prussia, but failed because of the late maturity of the Italian varieties imported. Experiments with the yellow lupin (*L. luteus*) were more successful. This species was sown for the first time in Germany in 1841, by a farmer named Borchardt in the Mark of Brandenburg. Borchardt was active in encouraging its wider use in the years following.

The spread of the yellow lupin as a green manure plant, principally on the light sandy soils of Eastern Germany, coincided with a boom in wool prices and sheep rearing in Central Europe. Happily it was found that sheep, but not other stock, ate lupins in spite of the bitter alkaloids they contained. This knowledge undoubtedly penetrated gradually, and probably lupins were at first fed in small quantities, mostly in the form of straw or hay as stable feed in the winter.

The double usefulness of lupins resulted in a quick increase in their acreage, especially on larger farms on sandy soils where the chief source of income was sheep-raising. It is reported that by about 1860 there were farms in Eastern Germany with up to 50 percent of their acreage under lupins—a figure which is interestingly similar to that reported by Neil, Toms and Ralph (1960) in their survey of lupinosis-affected farms in Western Australia. At that time the yellow lupin was known in Germany as "the Gold of the Sand". One may suggest that many flocks of sheep were fed exclusively on lupins throughout the winter (Hackbarth 1942).

About 1870 this development was interrupted by alarming stories of a new disease

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This article was edited for publication in English by Dr. J. S. Gladstones, Institute of Agriculture, University of Western Australia, Nedlands, W.A.

which had caused heavy losses. The earliest report goes back to 1862. After 1872 the cases reached such proportions that in 1880, 14,138 of a total number of 240,000 sheep in one district in Pomerania died of lupinosis.

In most cases the malady arose quite suddenly. The chief symptoms were refusal of food, high fever, rapid respiration, thirst, constipation, trembling, gnashing of the teeth and lowering of the head, swollen head, and jaundice of the visible mucous membranes. Dissection showed, in addition, jaundice of the interior mucous membranes, swollen and inflamed liver, and considerable enlargement of the gall-bladder and kidneys. The animals died within 3-4 days (Liebscher 1880). It will be seen by comparing these symptoms with those newly described in South Africa and Australia (Bennetts 1957, 1960) that we are apparently dealing with the same disease.

The causes of lupin disease were investigated in detail by Kühn and his collaborators at the Agricultural Institute of the University of Halle (Kühn 1880, Liebscher 1880). Because the disease did not occur universally after lupin feeding it was thought that fungal infection of the fodder might be responsible. In wet years the yellow lupin dries very slowly and is often severely attacked by moulds. However mouldy lupin straw or hay did not always give rise to the disease in sheep, while several lots designated as "injurious" were practically free of fungal infection. Furthermore there were cases of lupinosis after grazing on young lupins which were surely not infected by fungi.

It was natural to suggest that lupin alkaloids were the cause of lupinosis, and several trials were carried out to clear up this question.

Firstly the work of Dammann must be mentioned. Feeding hay, pods, and chaff of lupins which had caused severe losses in a large flock, he noticed nervous symptoms but no jaundice.

Krocker (1880) investigated the question of whether "poisoned" lupin hay had a higher alkaloid content than "unpoisoned" hay. This was found to be the case in one instance but not in another.

Liebscher (1880) carried out a series of trials with extracted alkaloids. Subcutaneous and intravenous injections produced nervous symptoms in rabbits and led to death within a short time. The same results were obtained with proportionately higher doses introduced into the stomach. Similar trials were conducted with the single alkaloids spartein and lupinin with rabbits, frogs, and dogs. These had the same effects, but it was noticed that lupinin was less toxic than spartein.

Now Liebscher passed to trials with sheep. Three animals were at first fed seeds from which the bitter principle had been removed artificially and safe lupin hay. Then 4.0-7.5 grams of alkaloid mixture daily were administered by mouth. After three days the sheep refused feed and died with typical nervous symptoms. But there was no sign of jaundice, only inflammation of the stomach and intestines. In one case changes in the brain were noticed. It was concluded that the alkaloids were the cause of death. Further investigations to see whether "poisoned" lupins had a higher alkaloid content than "non-poisoned" ones were inconclusive, however. It must be kept in mind that the methods of alkaloid determination available at the time were not very reliable.

A more complicated picture was presented by another experiment, in which sheep were fed "poisoned" hay, after "non-poisoned" hay from an experimental field had caused only the well-known nervous symptoms. On feeding the "poisoned" hay there supervened a pronounced jaundice with severe changes in the liver and glands. In further trials Liebscher was able to show that the "poisoning" principle was destroyed by steaming and that it could be extracted with glycerine. It was named "Ictrogen" because of its ability to cause jaundice.

In more recent times Couch (1926) has studied lupin poisoning in the U.S.A. Occasional outbreaks have been recorded in stock grazing the numerous wild lupin species occurring there. Couch refers first to earlier trials of Black and Sollmann in which alcoholic extracts from *L. luteus, L. angustifolius* and *L. albus* and from three American species led every time to death, with typical nervous symptoms, in mice, rabbits, guinea pigs, and dogs when administered subcutaneously or interperitoneally.

Couch himself investigated the individual effects of the purified alkaloids spartein,

lupinin, lupanin, hyroxylupanin and spathulatin. With interperitoneal injections all the guinea pigs in these trials died. The most poisonous alkaloid was d-lupanin, the chief alkaloid of *L. angustifolius* and *L. albus*. Spartein was less poisonous by 5 per cent, lupinin by 10 per cent, spathulatin by 30 per cent, and hydroxylupanin by 90 per cent. Couch found the case for ictrogen unproved and took the view of simple poisoning by alkaloids.

In Poland, Rakowska-Grekowicz (1956), cited by Wierzchowski (1957), investigated the effect of the alkaloids of *L. albus* (mostly lupanin and hydroxylupanin) on rats by introducing graduated amounts into the stomach. After 15 days the daily dose per animal was 250 mg. None of the rats died, but on dissection severe changes of the liver and glands were apparent. In a further trial with smaller quantities given to young rats over a longer period there were disturbances in development and loss of appetite. Again, dissection showed marked changes in the liver and glands. The lethal dose of the mixture of alkaloids used was estimated at about 500 mg/kg live weight for rats.

Another method was used by Richter and Schiller (1956) in Germany. Rats were given feed whose protein content was made up of lupin seed meals of varying alkaloid contents. In this case the only rats to show any effect, a disturbance of reproductive power, were those whose protein was provided by pure bitter white lupin (*L. albus*) seeds with an alkaloid content of 2.47 per cent.

The question of toxicity of alkaloids, or of possible other substances associated with them, became more immediate when von Sengbusch succeeded in breeding varieties of lupins with the diminished alkaloid content of 0.01 to 0.05 per cent (see von Sengbusch 1942).

Von Sengbusch himself carried out a number of injection and feeding experiments in the years 1927-1930. Injection of guinea pigs with bitter lupin extracts caused death with the characteristic nervous symptoms already described. In feeding experiments, guinea pigs ate bitter lupins in normal quantities but sickened continuously and died within 14 days. Rabbits ate the seeds of yellow and blue bitter lupins after a short period of training and could be fed with them through several months, although the number of deaths in the early stages was admittedly greater than with normal feeding (about 16 per cent in the case of the yellow and 24 per cent with the blue). With the yellow lupins there was no external evidence of disease, but with the blue there were occasional convulsions, similar to those in animals injected with alkaloids. The greater degree of poisoning caused by lupanin, observed by Couch (1926), is therefore visible in this case also. Rabbits injected with extracts of alkaloid-poor lupin varieties showed no signs of poisoning.

Von Sengbusch (1934) also carried out feeding trials with sheep. Exclusive feeding with bitter yellow lupin seed for up to 18 months had no ill effect. However sheep receiving only bitter blue lupin seed showed a rapid decline in liveweight.

Feeding rabbits and guinea pigs with green lupin material did not result in any health disturbances so long as the whole plants were fed. But if the animals were given only the young shoots and leaves of *L. albus* they lost weight and died. Investigations showed that the top leaves had double the alkaloid content of the middle leaves and five times that of the lower ones.

Experiments carried out by Dobberstein and Walkiewicz (1933) with rabbits fed bitter lupins over a fairly long period are of special interest. There were no pathological changes in the internal organs of rabbits fed oats and the seeds of bitter *L. angustifolius*. Where seeds of bitter *L. luteus* were used, however, the livers showed severe chronic changes (Figure 1). The livers were characterised by a decline in glycogen,

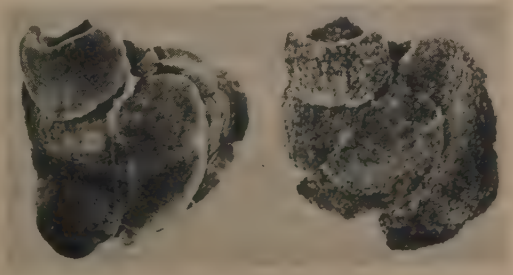

Figure 1—Livers of rabbits fed seeds of bitter yellow lupin (L. luteus) for 3 months (left) and 7 months (right). After Dobberstein and Walkiewicz (1933).

pathologically increased fat and cell production, and in consequence a more or less rapidly progressive brown atrophy. The fall in glycogen content became noticeable after 7 days. Cell division increased quickly, and after 4-5 weeks appeared the disturbances in fat metabolism, similar to those observed by Liebscher (1880).

Feeding trials with large domestic animals other than sheep are difficult because they do not readily eat rations containing bitter lupins. In trials carried out by von Sengbusch (1934) pigs would not eat rations containing more than 5 per cent bitter lupins. In the trials of Richter and Schiller (1956) the rations used, all containing 12 per cent lupin seed, had alkaloid contents of 0.017, 0.08, 0.10 and 0.25 per cent respectively. The animals ate the rations with higher alkaloid contents only after some delay, but no health disturbances were noticed.

A case of poisoning in cows and calves is referred to by Kolowca (1951) (cited by Wierzchowski 1957). Feeding bitter blue lupins ensiled together with sugar beet leaves and 5 per cent lupin seed meal to a herd of 21 animals resulted in acute poisoning in 5 cases and chronic effects in 9.

Because of lupinosis the practice of feeding lupins to sheep in Germany declined after about 1880, and interest in the disease disappeared. At the same time agriculture there was becoming more intensified. Sheep raising became uneconomic and passed to other countries, notably Australia. Lupins were grown only on the lightest of sandy soils, and only for green manuring.

However the very high protein content of the seeds, and indeed of the whole plants, led to the development of processes to remove the bitter substances, so that lupins could be fed to all kinds of stock. Several methods were worked out, that of Kellner being widely used in the years during and following the first world war. It consisted of boiling the seeds and then washing them in cold flowing water. The alkaloids were dissolved out, but serious losses of protein occurred also. As far as is known there were no cases of poisoning by lupin seeds treated in this way.

The breeding of Sweet Lupins*

Von Rümcker, at the beginning of the present century was the first to raise the question of whether it might not be possible to breed varieties free of alkaloids. The desirability of such varieties stemmed partly from the fact that artificial "de-bittering" was practicable only with the seeds. With naturally alkaloid-free varieties it would be possible to take advantage of the high protein content of the whole plant. Early investigations towards this end were carried out by Roemer in Germany and Prianishnikoff in Russia, but without success. It was Professor Erwin Baur who later reopened the question, inferring from the results of mutation research that it should be possible to isolate alkaloid-free individuals if sufficient plants were tested.

In accordance with this idea, Dr. R. von Sengbusch elaborated suitable chemical methods for testing large numbers of single plants, and by testing some 1.5 million plants he succeeded between 1927 and 1931 in isolating a number of individuals with diminished alkaloid content within the species *L. luteus, L. angustifolius* and *L. albus*. From these plants originated most of the "alkaloid-poor" varieties now in cultivation. They are not entirely alkaloid-free, but contain between 0.02 and 0.04 per cent total alkaloids, compared with a normal level of about 1 per cent in bitter lupins.

The first small parcels of seed were distributed to German farmers in 1933. The subsequent progress of sweet lupin cultivation for seed production may be seen in Table 1.

A regular increase occurred up to 1938. The regression in 1939-40 was caused by the war. With recognition of the value of sweet lupins as a protein source, however, large areas were sown in occupied Poland and Hungary. Statistics for these areas are unfortunately not available; nor are there any statistics for Germany as a whole for 1949-52.

The main seed-producing areas now lie in the Soviet Zone of Germany. Sweet lupin cul-

*Most of the German varieties are designated "Süsslupine" ("Sweet Lupin"). These terms are protected by patent in Germany and many other countries, and may be applied only to the varieties of the Süsslupine Zücht-und Verwertungsgesellschaft of Hamburg.

tivation in the Federal Republic is almost exclusively for green forage, climatic conditions being generally unsuitable for seed production. Because it is not possible at present to import seed from the Soviet Zone, the Federal Republic depends on seed imports from South Africa, and to a lesser extent from Poland and Hungary.

TABLE 1

Sowings of sweet lupins in Germany for seed production (after Hackbarth and Troll 1960)

	Whole Germany	Federal Republic (West Germany)	East Germany*
1928	3 plants		
1929	118 „		
1930	3,000 „		
1931	2 ha		
1932	45 „		
1933	500 „		
1934	3,800 „		
1935	12,179 „		
1936	24,999 „		
1937	47,664 „		
1938	78,456 „		
1939	56,874 „		
1940	52,216 „		
1941	37,585 „		
1942	43,230 „		
1943	48,711 „		
1949		13,637 ha	— ha
1950		8,444 „	— „
1951		6,938 „	— „
1952		5,482 „	— „
1953		3,038 „	19,745 „
1954		1,712 „	24,471 „
1955		989 „	15,192 „
1956		—	13,538 „
1957		597 „	23,234 „

*Much of the pre-war seed producing area of Eastern Germany is now under Polish Administration.

Much of the old-established seed-producing area of East Prussia is now under Polish administration, and sweet lupin cultivation is of great value in the old Polish state as well (Barbacki 1952, Hackbarth 1958). In Hungary, the cultivation of sweet lupins which started during the war has expanded greatly during the last few years.

Some bitter lupins are still grown in Central Europe, but only for green manuring. Use of bitter lupins for stock feed in this region, even for sheep, has disappeared completely. In contrast, the alkaloid-poor varieties of *L. luteus, L. angustifolius* and *L. albus* are being fed to all classes of stock with excellent results, both as grain and, what is more important, as green feed.

Feeding of sweet lupins

Von Sengbusch himself carried out the first feeding trials with sweet lupins. As soon as sufficient seed became available, comprehensive feeding trials were undertaken at several institutes, most notably at the Institute of Physiology of Domestic Animals under the direction of Mangold (see Mangold 1949). Information obtained from these trials and later ones carried out in Germany, Poland, Sweden, the Netherlands and elsewhere is summarised by Hackbarth and Husfeld (1939) and Hackbarth and Troll (1960).

The most important point to emerge from these trials, in regard to the present problem, is that in no instance did health disturbances occur where the new varieties were fed. This was true not only for sheep but for all other domestic animals as well, including the very sensitive pig. It is now known that the alkaloid-poor varieties can also be employed for human nutrition, having been used quite widely for this purpose in Germany during the Second World War.

It must be admitted that some apparent cases of poisoning have been reported. Meyer-Bahlburg (1949) deals with severe poisoning in a dairy herd in Schleswig-Holstein, after feeding of "alkaloid-free" blue lupins. The lupins had been sown for green manuring with imported seed certified as "free from bitter principle". The cows were fed this material three times in two days and ate the succulent fodder willingly. However after the third meal all the symptoms of severe lupinosis were noted: jaundice, constipation, fever, and nervous troubles. Analysis of the green material revealed that 50 per cent of the plants were bitter. Moreover, these young plants had an especially high alkaloid content.

Wierzchowski (1952) refers to several cases of poisoning of horses and pigs in Poland, brought about by contamination of sweet lupins with bitter varieties. With pigs, feeding "alkaloid-poor" lupins with an alkaloid content of

only 0.1 per cent has been known to cause trouble (Schmidt 1957). The danger of contamination is particularly great in Poland, because in that country large scale sowing of bitter lupins has continued up to the present time. With *L. angustifolius* the only danger is of mechanical admixture, but with *L. luteus* and *L. albus* there is the added danger of cross-pollination. As in Germany, feeding sweet lupins free of contamination with bitter varieties has never been known to cause lupinosis.

Wierzchowski (1957) and other Polish authors conclude that feeding lupins is completely without risk only where their alkaloid content is not above 0.05 per cent.

Lupinosis and dietary imbalance

The opinion has occasionally been expressed in the literature that the high protein content of lupins causes poisoning. This has been stated recently by Flight (1956) in South Africa in reference to sheep grazing the fallen seeds of *L. angustifolius* in summer. Flight also states that lupinosis is due to deficiency of methionine, whose content in *L. angustifolius* is low.

Bennetts (1957) has suggested that pathological changes in the liver might be due to choline deficiency.

These ideas are, however, inconsistent with the results of feeding experiments by Dobberstein and Walkiewicz (1933) and von Sengbusch (1934) with rabbits. Prolonged feeding with bitter yellow lupins led to pathological liver changes. But it is significant that these changes did not occur in animals fed the sweet varieties.

As an answer to the question of protein overfeeding, the trials of Columbus (1935) and von Sengbusch (1934) will serve. In the former trial, rats were fed exclusively with sweet lupins through four generations without any disturbances in health. Von Sengbusch fed some groups of guinea pigs only with bitter lupins and others only with alkaloid-poor varieties. While the animals in the former groups died within 2-3 weeks of alkaloid poisoning, the latter developed normally, even though they ate larger quantities than a control series fed with oats. Further, it has been shown by Bronsch and Drepper (1958), and Drepper and Bronsch (1959), that poisoning by excessive protein does not occur so long as the secretory organs are intact. These results also contradict the hypothesis that amino-acid deficiencies are involved.

Discussion

Lupinosis does not occur only in sheep. All animals may be affected. There is no doubt, however, that the most serious trouble has been with sheep, since these are the only domestic animals which will normally eat bitter lupins in quantity.

It is curious that, in all countries where the feeding of bitter lupins has been introduced, lupinosis has only appeared after a number of years. It is the writer's opinion that this is because initially other feed is given in addition to the lupins. Gradually farmers proceed to exclusive lupin feeding. In some cases in Europe sheep have received little but lupins through the whole year, as green feed during summer, and hay or even seeds alone during the winter. According to Bennetts (1957) and Neil, Toms and Ralph (1960), similar factors may be at work in Western Australia. Bennetts recommends that lupins should not constitute more than 30 per cent of the diet.

What, then, is the cause of lupinosis? Is it caused by overfeeding of protein, deficiency of certain amino acids, or poisoning by lupin alkaloids? Or is it due to some other substance, such as "ictrogen"?

To the present author, it seems clear that alkaloids are the cause of lupinosis. If alkaloids have not induced organic changes in the liver and other organs in the trials of Liebscher (1880) and Kühn (1880), these observations are refuted by the experiments of Dobberstein and Walkiewicz (1933), von Sengbusch (1934), and Rakowska-Grekowicz (1956).

The most striking evidence, however, that alkaloids alone cause lupinosis lies in the fact that the new "sweet" varieties which have been selected in several lupin species are being widely fed to the most sensitive species of animals without producing any sign of lupinosis. The slight alkaloid content of these varieties apparently does not reach toxic levels, even with exclusive lupin feeding.

But what of "ictrogen"? To be on the safe side, von Sengbusch in his first publications

made the reservation that sweet lupins would be safe only insofar as they would not cause alkaloid poisoning. About "ictrogen" he made no predictions, beyond observing that the sweet varieties would provide material with which tests for ictrogen could be carried out with sensitive species, such as guinea pigs, in the absence of the complicating effects of alkaloids.

The results of all such tests for ictrogen have been negative. With this evidence and the fact that sweet lupins are now being safely used in many parts of the world, the existence of "ictrogen" may be doubted indeed, unless it is a substance which is formed only in the presence of alkaloids.

In trying to solve the problem of lupinosis in Western Australia, the first task should be to see how far the bitter lupins grown at present can be replaced by sweet varieties, which are available within the species *L. luteus, L. angustifolius,* and *L. albus.* Promising results with these varieties have been reported by Gladstones (1959). In the case of *L. digitatus,* whose suitability to Western Australian conditions has already been proved, breeding of a variety with low alkaloid content should be initiated. From the experience with other lupin species this would almost certainly be possible.

Bennetts (1960) wrote that it seemed difficult to believe that lupinosis had ceased to be a problem in Europe since the use of sweet lupins became general. But this has indeed been the case. It was because of lupinosis that the use of bitter lupins for sheep feed died out, and it was only after the introduction of sweet varieties that the use of lupins for stock feed again became possible.

Summary

Evidence is presented that lupin alkaloids are the cause of lupinosis. Administration of lupin alkaloids to experimental animals has given variable results, but the effects produced have been sufficient to account for lupinosis symptoms as they occur in the field. Strong support for this conclusion comes from the fact that in no recorded case have "sweet" (low alkaloid) lupins ever caused lupinosis.

The evidence refutes any hypotheses that lupinosis is caused by amino-acid deficiencies or overfeeding with protein. Nor has recent work supported the theory that a special toxin, or "ictrogen", must be present apart from the alkaloids. If such a substance exists, its origin must be dependent on the presence of a high alkaloid content.

It is concluded that the best way of avoiding lupinosis lies in the use of sweet lupin varieties.

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Articles

EXTENSION— A PHILOSOPHY, A SCIENCE, AND A PROFESSION

C. I. A. BEALE

In 1959 the Council of the Institute decided to initiate an inquiry into the state of extension in Australia and to seek ways and means of contributing to an improvement in this field if it was found that such action was warranted. In line with this policy, I was appointed to convene a sub-committee by the New South Wales Branch with the same objectives in view, but with particular reference to conditions in this State.

A report was subsequently prepared and forwarded to Council by the Branch Committee of Management to assist the Federal body in its task. It now seems appropriate to make a report to the wider membership of the Institute in order to provoke discussion of this important topic.

The views presented will be based on the Sub-Committee's report and the inquiries and reading which led up to it. They will not necessarily coincide with the views of the members of the Sub-Committee and therefore should be regarded solely as my own.

I should like to take the opportunity of acknowledging the hard work and considerable thought given to time-consuming duties by the members, J. D. McFarlane and J. L. Rees.

The Raison D'Etre of Agricultural Science

The late Sir Ian Clunies Ross, in an address to the Australian Capital Territory Branch of the Institute in 1958 on the contribution of science to the future of agriculture, concluded his remarks with the following words:

> "The key to successful agriculture rests on the integrated efforts not only of scientists but of extension workers, engineers, economists, and specialists from a host of miscellaneous disciplines. As professional agriculturists we should welcome and encourage this integrated effort. But as human beings we must look beyond the realm of strictly material matters to things of the spirit from which alone can come better understanding between men. If we have not in mind the sociological and even the spiritual goals towards which our technological effort is directed, we may well find our grandiose scientific and technological civilization falling in ruins about us."

It may not be easy for scientists to discuss matters of the spirit, but it is important for all of them to maintain a due sense of proportion in the work they do and to recognize common goals.

Enclosed within the highly specialized tissues of the plant that is agricultural science, divided into specialized cells within those tissues, and still further divided by the continuing mitosis of increasing specialization, it is easy for agricultural scientists to forget that there are other species that contribute to the climax vegetation

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This article is based on his Presidential Address to the New South Wales Branch in February, 1961.

of human social and economic relationships, and that each constituent must be regarded as a part of the whole if a due sense of proportion is to be maintained.

As scientists we love to say to one another, "Oh, yes, that statement is all right as far as it goes. But you have to bear in mind these or those other criteria if you are to obtain a *true* picture!" Everyone knows how arguments develop progressively in this way during afternoon tea-breaks at the university, at Institute meetings, field days, or on other occasions when we get together. Each successive debater throws more light on the problem and in the course of argument helps the others to see it in better perspective.

Despite increasing specialization, we should try to cultivate a sense of perspective; we should widen our horizons; we should recognize ultimate objectives, not merely within agricultural science, not merely within the agricultural world, but within the whole field of human relationships.

Professor Heady, of Iowa State College, has elaborated this point in discussing the relationship between means and ends (Heady, Earl O.: "Economics of Production and Resource Use", Prentice-Hall, New York, 1952). With the aid of a diagram (Figure 1) he has demonstrated how the relationship passes from physical resources through physical sciences, organized capital, land, and human resources, to the intermediate ends of material gain. These ends become the means of higher living standards and "the maximization of satisfaction or welfare". Thence a point "U" is reached which represents the ultimate end or highest value attainable. Heady was concerned with explaining the role of production economics in this process, but his description demonstrates equally well the role of agricultural science.

Clearly if we, as human beings, are to aim at reaching point "U", it is very much our concern if any bottlenecks occur along the way. Furthermore, if those bottlenecks occur within our own sphere of influence and restrict the effectiveness of our own contribution to society, it is our special duty to widen them to the greatest possible extent. Thus we make our maximum contribution to the common good.

As scientists we claim that we are seekers after truth, as agricultural scientists we seek the truth concerning agriculture. Let us ensure that we do not waste our efforts by failing to impart that truth to good effect!

Extension—A Philosophy

What is meant by this curious word, extension? As particularly applied to agriculture it is of fairly recent derivation and apparently came to this country from America in the late 1920's or early 1930's. The closest dictionary definition of extension in this context is contained in Cassel's New English Dictionary under University Extension, which is described as "a system by which university instruction is extended to non-members of universities by means of lectures, classes, and examinations". The specialized use of the word as applied to agriculture is no doubt derived from this meaning and reflects the fact that in the U.S.A. the universities play an important part in agricultural extension. As used in Australia, however, it seems to be one of those words which "mean all things to all men".

The Sub-Committee felt that a very narrow view of the meaning of agricultural extension was prevalent. It considered that a clear philosophy was required and that this should become widely recognized and accepted in Australia. It found that the word had many connotations and implications, and I will try to put the more important ones before you. I might as well begin by quoting from the report:

> "Extension activities among rural conditions must first consider man as a producer charged with the prime object of moulding the things in the environment in order to satisfy human physical

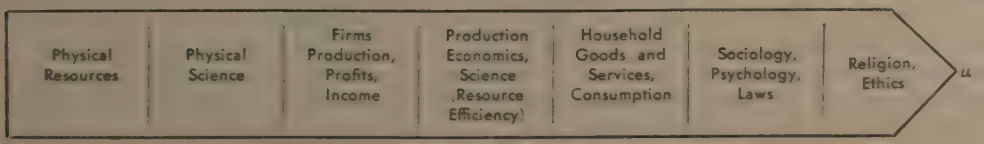

Figure 1—Relationships between means and ends. After Heady (1952).

needs, and then consider the important fact that the producer has to spend his life in close association with other men, needing their co-operation in order to survive economically and socially.

Successful extension is not a system but a progressive function operating to meet changing needs, both in his occupation and in his social environment. Extension is concerned with change."

Extension is also a form of education and education is not simply a matter of handing out facts but is rather a process whereby the student is taught how to think. One of the best forms of assistance which can be given to the farmer is to teach him how to set about defining and tackling his own problems. Associated with this, too, is the development of his own inventive skills. Until the modern scientific revolution in agriculture, almost all progress was derived from the ingenuity of the farmers themselves. A large proportion of present-day progress in the development of new ideas and new techniques is still due to farmers. Scientists should recognize this fact and encourage farmers to find their own answers.

At the same time, farmers themselves should accept some responsibility for the quality of the extension that they receive. They should have a part in initiating, planning, and carrying out research and extension programs. It was suggested to the Sub-Committee that extension workers and farmers alike should adopt as a motto, "Learn to do through doing". As an illustration of the possibilities, the highly successful work of sorghum silage under Dr. Skerman, of Queensland University, was quoted (Skerman, P. J.: "Cropping for Fodder Conservation and Pasture Production in the Woolgrowing Areas of Western Queensland", University of Queensland Papers, Department of Agriculuture, Vol. I, No. 3, 1958). This form of "opportunity farming" in north-western Queensland, where sufficient soil moisture to grow a crop is found in two years out of every five, was initiated by farmers, and the associated research and extension work has been carried on ever since with their full co-operation at every stage. They are learning the techniques as they develop and these are being widely adopted throughout the area.

Extension is also very much concerned with education of the young. In the words of our report again:

"Another aspect of extension is the training for leadership and self-expression in their widest form. This is work of special importance to young people who, being young, express greater desires to be creative. Young people are most anxious to be recognized but fail to convey this because there are few institutions in which they can participate in scientific or social activities. Young people should be trained to take an active part in rural development. If there are few means whereby they can participate in common activities they will look outside rural areas for opportunities."

Extension is concerned with people—all people, rural folk and city dwellers alike—and people, in turn, are concerned with their own aspirations to live a worthwhile and contented life. While extension benefits country folk in a direct and personal way it is just as important indirectly for the city dwellers in a country like Australia where the economy depends so heavily on the prosperity of the primary producers. National policy aims, therefore, have some implications for extension which cannot be ignored and, to a certain extent, these inevitably conflict with the interests of the producers themselves. However, compromise is the essence of democracy, and while extension men serve different masters, they should recognize common broad objectives and design their work accordingly.

Agricultural economists, engaged as they are in a relatively new and rapidly developing science, have brought a refreshingly sane and balanced point of view to bear on the subject of technical innovation. We are all familiar by now with the concept of the "whole farm approach" in extension work, although as yet few do or are able to put it into practice.

It is well recognized that increased production for its own sake is not enough. The extra production has to be profitable, and has to be as profitable as possible recognizing the opportunities provided by the alternatives.

Furthermore, as the economists say, the farmer is an individual whose own experience, aptitudes, and preferences must be recognised in suggesting alternative plans of action. He must bear the ultimate responsibility for all decisions made with regard to his farm and he therefore has the right of choice as to what shall be done. The choice he makes will depend

upon himself and the alternatives placed before him should take full account of this. The good farmer listens to advice and makes his own decisions. From the extension worker's point of view, as I once heard from an eminent member of our profession, "Heaven preserve us from *persuading* the farmer to do *anything!*"

However, many agricultural economists do not go far enough in applying perspective to the work of extension. In the first issue of a new journal called "Farm Policy", Schapper and Parker, of the Institute of Agriculture, University of Western Australia, write these words:

> "The immediate purpose of farm management extension is to provide the farmer with ideas and information which will help him to achieve maximum economic efficiency or highest possible net income. For this reason advisers are often accused of being too money-conscious and of forgetting that farming is also a way of life. Farm management advisers, however, are inclined to the view that the more efficient the farmer the higher will be his net income and the more readily will he be able to achieve his way of life goals."

This is a common view and doubtless the argument would be valid in the majority of cases. But if the way of life goals are regarded as paramount, care should be taken to ensure that they are not sacrificed for the more immediate aim of economic efficiency.

In any case, not all farmers *want* to make as much money as they can. Consider, for example, the older ones who find it difficult to change their ways, who are happy as they are, but would possibly be glad of a little more money without greatly added work and responsibility. Also, there is the younger man with four or five children and a wife who is overworked, living in an old-fashioned, poorly equipped home. Would he be better to spend his ready cash on improving his property with a view to obtaining a better income at some time in the future, or should he spend at least some of it on a new kitchen range, a hot-water system, and a few other amenities about the home which would make a happier life for his family and himself? Farm and home compete with one another for the available capital and labour, or leisure time, and the farmer has always to decide how these are to be allocated.

Economics is concerned with choice. The faith demands that choice be exercised to obtain maximum income from scarce resources. Let us take the matter a stage further with regard to extension and say that we are concerned with maximization of *social welfare* from scarce resources. Motivation is the spur to action. If farmers cannot identify the ideas put before them with their own situation and their own desires, they are unlikely to make use of them.

To conclude this discussion of the philosophy of extension the Sub-Committee's report may be quoted once again:

> "A prosperous rural countryside can only come from the application of knowledge, both pertaining to the farmer and to the social conditions under which country people live. To increase productivity is the first essential of any extension service, but to go no further than production would leave a big gap in the aspirations of people to lead a contented life."

Extension—A Science

In their preoccupation with the physical and biological sciences in both extension work and the formal schools of learning, agricultural scientists tend to ignore the fact that teaching and extension are themselves subjects worthy of scientific study.

University staffs, school teachers, and extension workers are selected for their posts on a basis of achievements in their several disciplines, and not because they are good teachers. This may seem inevitable, but with all due respect to these people, many of them know very little about teaching and learning. In effect, one says, "The best scientific brains are available to the students. Their teachers are specialists in their fields; they are fully in touch with the latest scientific knowledge and are themselves research workers of no mean talent; they excel at inquiry, definition, evaluation, and solution, but so far as teaching is concerned—well, they have always been left to their own devices".

It is worth stressing again that extension and teaching are primarily concerned with people. Ideas cannot be projected satisfactorily without an understanding of those with whom one is trying to communicate.

There is a great need for development of a science of extension in this country. Many existing disciplines might be drawn upon, but chief among them are psychology, sociology and education.

Extension workers must learn something of the pathways of the human mind; the nature and development of personality and of attitudes; individual differences in ability and personality; the processes by which people acquire knowledge, and the factors which prompt them to act on that knowledge.

Extension workers must also understand how people form and associate themselves with social groups. They must understand group psychology, the development of group attitudes, and ways and means of predisposing groups to identify new ideas with their own circumstances. They require a sufficient understanding of learning theory and teaching techniques.

Extension workers in the field have to cope with a host of social and psychological problems. Up to the present they have had no training to deal with them outside the hard school of experience. Some of these problems have been overcome by imaginative men with an intuitive ability in human relationships. Others, not having the ability, have failed in similar situations. But in some cases the problems have been insoluble for the best amateurs.

Ignorance, antagonism, and apathy are some of the notorious enemies of the extension man. Scientific training in extension is essential if these problems are to be overcome.

Current Concepts of Extension in New South Wales

The extension situation as revealed to the Sub-Committee was most depressing. Widespread views were found that extension, both in this State and throughout Australia, was poorly developed in relation to the needs. Research had been increasing rapidly, farming was becoming more complex, and capital investment on farms was rising. Yet extension had shown little growth in relation to an obvious need.

The evidence showed a great deal of frustration on all sides and Governments should be aware of this. At a time of rising costs and falling prices, the main hope for primary producers, as they know, lies in increased efficiency of production. For this they need guidance in tackling their problems, information on the latest techniques, and advice on how to apply them. The majority just cannot obtain this information and advice.

Research men feel frustrated because the information they are obtaining is banking up and not reaching the producers. Extension men feel frustrated because they are too few in number and their facilities and equipment are inadequate for the task. Administrators are frustrated because they cannot obtain the money and suitably qualified men. Yet on the other hand, university graduates in agricultural science, the very men who should be doing the extension, are not applying for the vacant jobs.

There are many reasons for this, of course, but I believe that the frustration is basically due to a number of false concepts concerning the role of extension in agriculture and the methods of carrying it out.

Strong evidence shows that agricultural scientists and others commonly regard extension as a second-rate professional activity compared with research. More research workers have higher degrees than graduate extension workers, on average they are more highly paid, and the results of their work are more readily seen and therefore are more widely publicized. Little attention is given to extension in university courses and certainly no training in the related sciences, whereas students are taught to worship at the shrine of research from the beginning of their courses.

Few opportunities of following an extension career exist outside the Departments of Agriculture and Conservation, and for those who do enter these Departments the marginal reward for possessing a degree is very small. Apart from an intensive course lasting a few days in public speaking, the use of visual aids and so forth, the newly-appointed, would-be extension officer receives no in-service training to fit him for his duties. He is normally posted to an experiment farm for a number of years before being sent to learn his trade as a sort of cadet with an experienced man in the field. This could hardly be described as an exciting prospect for the young graduate. In such

circumstances I would say that extension *is* a second-rate professional activity compared to the alternatives available in research and elsewhere.

Another false concept concerning extension is that it should be almost exclusively a function of government. The impact made so far by private extension agencies in Australia has been very small and people naturally think only of the government services in considering the "extension problem". Accordingly, it is perhaps not surprising that the Sub-Committee found a widely held view that the problem could be resolved solely in terms of men and money. A large proportion of the people interviewed felt that a bigger appropriation to the Department of Agriculture would make it possible to pay higher salaries and employ more men. This, it was felt, would satisfy the main requirement. But such arguments ignore several considerations including the cost to the taxpayer, the competing demands of other government services, and the fact that, say, 60 well paid, highly trained district agronomists would hardly make a notable increase in effective representation among 77,000 rural holdings in New South Wales as compared with the present 30-odd poorly paid ones.

A government service, in any case, has other disadvantages. However altruistic the motives of the officers who belong to the service, the fact remains that their advisory functions are inextricably interwoven with inspectorial duties and the enforcement of various Acts and decrees. Such work is not conducive to building up the confidence required between adviser and farmer, which is so necessary for effective extension.

Furthermore, government extension tends to be political. Some compromise between national policy aims and the personal aspirations of farmers is necessary, but the appropriate field for promoting policy aims lies more in the realm of the legislature than the administration. Government instrumentalities concern themselves too much with the promotion of import-saving crops, the establishment of closer settlement schemes, irrigation schemes, and the like. Such considerations provide undertones of persuasian in extension work, and create distrust rather than co-operation.

Of course, I do not mean to suggest that Departments of Agriculture should not carry out extension. The taxpayer benefits, so he should be prepared to pay for part of the cost. Also, a large organization has considerable economies of scale, particularly in the maintenance of laboratories, experiment stations, and research staff. Such an organization would be of little value without means of passing on the information accumulated. The matters for concern rather are how big it should be allowed to grow and how close a contact with individual farmers it should try to maintain. After all, the latter gain more from extension services than the rest of the community. It is therefore not unreasonable to expect them also to bear part of the cost.

Perhaps the most important false concept of all is the one that regards extension solely as a process of channelling technical information to farmers, and bases evaluation of this process on the rate of adoption of new techniques.

New techniques are of no value in themselves. Here we return once again to the subject of means and ends. Each farm is an individual organic unit. A given technique or idea is only of value as a means to an end on the right farm at the right time. It might be quite useless or even harmful on another farm. It would be no triumph, for example, if as a result of a concerted extension program, 25 farmers in a district had installed spray irrigation plants in 1960, when ten would have been better off by increasing their areas of improved pasture, seven should have bought more sheep, five were not particularly good managers and would be unlikely to make a success of a complicated enterprise, and only three were really likely to profit from the venture!

A Policy for the Future

The structure of agricultural extension as it exists in Australia today is largely a product of the needs existing in the last decade of the nineteenth century and the early years of this century.

This statement does not ignore the fact that important changes in organization have been made in the intervening period, that the scope

and functions of the various bodies concerned have been greatly widened and intensified, and that science has played a greatly increased role. But the needs of the community have changed and will continue to change. Yet the organization has not altered sufficiently to meet new needs.

When the name of the Department of Mines was altered in 1890 to the Department of Mines and Agriculture and a board of agriculture was set up under its own director, the first step was taken in the development of organized research and extension services in New South Wales.

Until that date little agriculture had been taught in the Colony's schools. Since 1872 a gold medal had been awarded annually for the encouragement of "agricultural chemistry—practical and theoretical". Under the patronage of the Board of Technical Education and later the Technical Branch of the Public Instruction Department, "much interest had been awakened, and distinct progress made by many of the classes in the principles of agriculture taught by Mr. Angus Mackay, F.C.S.", who had also written several text-books on agriculture.

Hawkesbury Agricultural College was founded at about this time and formal study of agricultural science at university level did not exist in Australia until 20 years later, when the School of Agriculture was founded at Sydney University.

Agricultural science, of course, was in its infancy. Nowhere in the world had much progress been made, but in a country relying so heavily on primary production and still in the early stages of development, the need for government initiative was obvious.

The main object of the Department as laid down in February 1890 by the Minister for Mines and Agriculture, and as described by the Director of Agriculture in his first report to the Under-Secretary, was "to make the farmer's condition more stable, and thus raise the status of settlers, who will found a generation of farmers, instead of dummies, to make agriculture the mainstay of the country".

Incidentally, the Director also drew attention in terms not unfamiliar to us today, to the necessity for a good rural journal as a means of extension. "So long", he said, "as a very thrilling murder or other sensational matter does not encroach too much upon the space devoted to agricultural topics by the average country paper, the farmers get a very fair amount of valuable matter, culled from the best sources available; but there is still room for a farmer's paper, like the 'American Agriculturist', which should be exclusively his from cover to cover".

Out of a desire for a stable agriculture and the national prosperity which it was felt would surely follow, and out of the somewhat sentimental ideas of the time, again disclosed by the Director's Report of 1891, "that we must have the land in the hands of as many free labourers as possible—labourers with a present and prospective interest in the soil they till, thus ensuring economy, patriotism, and progress", has arisen the Department of Agriculture as we know it today.

The work of the Department, since those days, along with that of the Department of Conservation is impressive. The progress that has been made reflects great credit on the Government and the staffs concerned. But how far will government instrumentalities, originally set up to meet very different needs, be able to meet those occurring in the future? Agriculture is afforded a greater degree of State paternalism than secondary industry or commerce. Can this inequality of treatment be perpetuated despite the decreasing proportionate value of agricultural production in the gross national product?

Technological change is bringing in its train a new assortment of problems, which require standards of management of a very high order. Farmers will require close and detailed advice to overcome these problems as they multiply.

Increasing production achieved by a static labour force with rapidly rising farm investment, such as has occurred over the last few years, can be expected to cause great changes in the structure of rural industry as well as increasing the complexity of farm business management. Increasing competition for available credit can be expected from the rapidly growing secondary and tertiary industries, and

this factor will complicate the situation still further. It seems that hopes of economic survival must lie with increasing efficiency and resort to economies of scale.

Prices paid for rural land have fallen little since the early 1950's and the common view is that this has been due, at least in part, to increasing purchases on the part of city investors. Options, leases, and purchases on behalf of large companies are increasingly reported in the newspapers. Despite the sturdy independence of the Australian farmer there is reason to wonder whether the family farm in its present form can long survive.

Changes come slowly in the country. We cannot expect them to happen over night. But changes will surely come. The pressures referred to, and others as well, cannot continue to build up without far-reaching effects.

Extension must be geared to meet changing needs. The organization must be flexible and plans must be made with a view to the future. For this the broad aims of extension must be clear. Clear aims require a clear and widely accepted philosophy, and a philosophy commonly has its origins in seats of learning. Thus we come to consideration of the role of universities in the field of extension and the need for establishing extension as a professional occupation in its own right. For all professions require the support of university research and teaching if they are to have the authority and prestige they require, or indeed, any worthwhile substance.

Extension—A Profession

The need to establish a science of agricultural extension has been discussed earlier. In fact, of course, such a science already exists. Or rather its several components exist, although scattered among a number of university faculties. What is required is the bringing together of these contributions to extension science under one roof, and the orientation of the work in the rural sphere.

Some notable contributions to the knowledge of extension in the form of descriptive rural sociology have been carried out in the Universities of Sydney and Melbourne. Other studies of the designing and execution of extension programs in the Murrumbidgee Irrigation Area and the background and attitudes of farmers in relation to extension services by the Department of Agriculture have been very informative. The conducting of rural schools for farmers by the Adult Education Department of the University of New England has achieved great popularity and success with the farmers concerned, besides yielding much useful information. Such activities are undoubtedly straws in the wind, but little progress can be made until faculties of agriculture, rural science, agricultural economics, and the like, begin to show a real enthusiasm for extension as a subject of study to be included in their curricula, and appoint the necessary staff.

The Extension Sub-Committee in its report considered that some provision for training of future extension officers in undergraduate courses was necessary. It suggested that lectures in extension subjects could be provided as optional courses in the third or fourth years. These would be aimed at providing undergraduates with a background of knowledge to be later consolidated in the field.

Secondly, it proposed that post-graduate courses be provided for graduates with some years of experience. These courses would carry the earlier training to a more advanced stage and would last for at least one university term and preferably a year, and should lead to examinations and the granting of a higher qualification.

There seems to be no reason why graduates should not undertake research into extension with a view to obtaining a Master's or Ph.D. degree. Men with such qualifications would be invaluable in extension organizations, and would help to raise extension to a professional status fully comparable with teaching and more orthodox lines of agricultural research.

The building of a professional extension body requires the provision of satisfactory employment opportunities. The State Government is likely to remain the major employer of extension workers for many years to come. If it wants a satisfactory extension service, it must consider the needs of its professional officers, or it will fail to attract university graduates to vacant posts. The new graduate surveys the field of opportunity that lies before him and

selects the one which he considers most likely to satisfy his desire for a worthwhile career with satisfactory conditions of employment and an attractive salary.

So long as the State Government fails to grant proper in-service training for its officers, or to provide adequate facilities for study and opportunities of attending scientific conferences or fails to pay the full market price in the form of salaries, it cannot expect to attract university graduates to extension work.

Moreover, extension should provide a full-time job and a life-time career. Government officers can hardly be freed from the responsibility of reporting breaches of the law in respect of various Acts of Parliament, but they should be freed from deliberate inspectorial functions. And it should be possible for a man to continue his career within extension instead of foregoing it for general administration as he rises in the service.

Some of the newer opportunities opening up in the extension field may be expected to attract agricultural scientists. I refer particularly to the growing body of private consultants in agriculture.

The growth of this movement may be expected to continue as one answer to the increasing complexity of farming, and the trend seems an altogether desirable one. What the professional man may lose in security of employment, prospects of promotion, and "perks" of various kinds by starting out on his own is being compensated in the right circumstances by great personal satisfaction in the work carried out, independence, and a remunerative income. The risks involved might not appeal to everyone, but the growth of private practice in the veterinary profession, where over half the members are engaged today, suggests that this movement might in time become a very strong one.

The future size of the farm management club movement is less certain since some fifty votes within a restricted area are required for every club formed. This movement also seems a desirable one, however. Apart from providing good employment conditions for the professional adviser, it involves self-help on the part of the farmer and his participation at every stage of the extension program from its initiation to application of the recommendations. Advisers will be required to have training in farm management as well as the normal qualifications of an agricultural scientist. The work should be satisfying because of the opportunity of giving close, personal advice and of seeing plans carried through to fruition.

Tactical Aims

The strategic aims of maximizing social welfare, developing a philosophy, a science, and a profession in extension, as well as a flexible attitude to changing needs, will require the adoption of suitable measures in the tactical field.

The familiar saying that extension involves a two-way flow of ideas from the research worker through the extension man to the farmer and back again certainly bears repeating. If research results are piling up at one end of the chain, and ill-defined problems remain unsolved at the other, it seems obvious that greater co-ordination is required. One would think that the national organization at present existing was adequate to cope with this co-ordination. The Agricultural Council, aided by the Standing Committee with its industry sub-committees comprising representatives from the major organizations concerned, is the supreme body co-ordinating policy. The universities are represented on C.S.I.R.O. research committees and officers of the C.S.I.R.O. and Departments of Agriculture deliver lectures in the universities. Much co-operation is carried out in various programs of laboratory and field research and the Agricultural Research Liaison Section of C.S.I.R.O. maintains some contact with Departments of Agriculture.

Nevertheless, extension is the weak link in the chain and something must be done about it. How well the organization works is difficult to tell from outside but it does appear that a good deal of unnecessary waste of scientific resources arises from inter-departmental friction.

Furthermore, appropriations of funds intended for research and extension are often disproportionately allocated to the former. There seems little point in allowing research to gallop ahead if extension is to be left without sufficient money to spend in passing on the findings to

farmers. Yet often the terms under which funds are handed to the industry sub-committees for distribution are unnecessarily restrictive. The Wool Research Fund is a case in point. The Committee is empowered only to finance work "which the States do not normally do". The result of this restriction has been that little money from the fund has been devoted to extension. In recent years the annual figure has been of the order of £10,000 out of a total income of about £1m.

The farming community should be admitted more widely into the fields of initiation and co-ordination of research and extension. If the Agricultural Council grants industry representation on its own advisory bodies, there seems to be no reason why Departments should not do the same. The farmers' representatives would soon see that administration of research and extension services is not a simple matter, and by taking part themselves would bring an important point of view to bear on the problems. Furthermore, they could help to smooth the Departments' path in seeking the co-operation of their colleagues.

The State Departments should recognize their own limitations as extension organizations. They cannot expect an indefinite expansion of their resources and must rely on increasing the effectiveness of those they have. A relatively small, well-equipped, highly-trained staff can be expected to do more good than one with the opposite characteristics. Professional men should not be employed on duties which can well be performed by less qualified men. Preoccupation with farm visits to anyone who calls for them is an uneconomic and not very effective means of extension. A far more subtle and efficacious method is to concentrate on the leaders in the farming community, the innovators, and the leaders of social groups. This is where extension science comes in. You have to know how to approach people, whom to approach, and the pathways by which ideas are disseminated.

Extension programs should be well planned, fully co-ordinated, and carried out intelligently and vigorously. The results should be properly evaluated and conclusions drawn as a basis for continually improving the method.

The use of mass media should be carefully controlled. Extension should not take the form of mass indoctrination, as farmers might easily be persuaded to adopt ideas unsuited to their circumstances. The press, radio, and television should be used to supply information to keep farmers up-to-date with what is going on around them. Television, particularly, can make a great impact on the viewer, and it is to be hoped that, as it is extended to country areas, it will not be used for a form of high-pressure advertising by extension agencies.

An important function of extension, already referred to, is the training of farmers to recognize their problems. This can be done through university tutorial classes, seminars, and extension schools. But more fundamentally, there is a need for teaching the basic sciences appropriate to agriculture in country schools. Future generations of farmers so trained would grow up better able to understand their problems, and better able to tackle them and obtain advice where necessary.

Finally, extension in the home is an important aspect which is too often neglected. Here again, the Sub-Committee's report may be quoted:

> "The home is the centre of the farm, and women the centre of the home. So far, the farmer's wife has received very little benefit from extension activities. This is unfortunate since her influence can be just as important in the successful running of the farm as the farmer's. Her influence may be indirect but nevertheless as important. To lighten her lot by removing some of the irksome duties she has to perform is a phase of extension demanding immediate attention. Improvement of the standard of living in this regard would enable the women to devote greater attention to the care of children, and since children are the most important crop we grow, extension to the farmer's wife would become, in the end, a national benefit."

In conclusion I would say that the above remarks should not be taken to mean that the extension situation in Australia is by any means all bad.

An attempt has been made to criticize the organization rather than the persons involved. In this all must take a share of the blame, for in the final analysis it is the whole community

which bears the responsibility for the institutions it tolerates.

Attitudes to extension are changing and in any case some of the existing institutions have all along taken a broad approach to the subject. Particular mention should be made of the Agricultural Bureaux organized by the Department of Agriculture in this State. The form of extension carried out by the Bureaux has all the elements of a comprehensive approach that I have discussed.

If this approach can only be developed and broadened, supported with science, and extension raised to its rightful equal status with other professional activities, much progress will have been made towards solving the "extension problem".

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PUBLIC SERVICE OF SOUTH AUSTRALIA

Applications for the position set out hereunder will be received by The Secretary, Department of Agriculture, Gawler Place, Adelaide, South Australia, until and including 7 July, 1961.

Applicants should state full names, address, date of birth, marital status, academic qualifications, practical experience, and give particulars of war service (if any). Copies only of testimonials should be submitted with the application.

The appointee may be required to contribute to the Government Superannuation Fund.

Department of Agriculture

SENIOR RESEARCH OFFICER (WOOL PRODUCTION)

Salary Range: £1,985-2,180 per annum.

Duties: Maintain and develop a Fleece Measurement service to Merino Studs and to give advice on modern breeding methods for wool sheep; act as consultant in the design, setting up and supervision of wool sheep trials at Departmental Research Centres; maintain liaison with workers in the fields of wool biology and genetics; assist with staff training, the conduct of schools and to prepare articles for publication.

Qualifications: A Degree in Veterinary or Agricultural Science. Evidence must be produced of a sound training in experimental techniques in the laboratory and the field and in population genetics, experimental design and analysis and fleece measurement. Thorough knowledge of the South Australian Merino stud industry and husbandry practices will be an advantage.

THE FAO FREEDOM FROM HUNGER CAMPAIGN

O. H. FRANKEL

The Freedom from Hunger Campaign of the Food and Agriculture Organization of the United Nations, first mooted in 1958 and officially inaugurated in July, 1960, has already aroused a great deal of public interest. In the coming years it is likely to strike the imagination of millions all over the world. Australia has played its part in discussions on the planning of the Campaign and is represented on the ten-member advisory committee. A national effort within the scope of the Campaign has been agreed upon between FAO and the Commonwealth Government, and the latter has made a contribution of £A8,000 towards FAO's administration expenses. An Australian National Campaign Committee has been formed.

The Australian Institute of Agricultural Science has taken an early interest in the Campaign. The problem of population and food cannot but make an impact on every thinking person today; even more so it must impress itself upon the minds of agricultural scientists who have a great deal to contribute towards its solution. This article was written at the request of the Journal to inform members of the Institute and others on the background to the Campaign, its purpose and programme, and the contribution Australian agricultural scientists may be able to make to its success.

The Purpose of the Campaign

In July, 1958, the Director-General of FAO, Dr. B. R. Sen, proposed to a session of the Economic and Social Council of the United Nations:

> "a campaign designed to focus public attention on a world-wide scale upon the continuing problem of hunger, and to mobilize national and international effort towards its solution. Notwithstanding the increasing efforts of national governments and international organizations, the spectre of near-famine and undernourishment still continues to haunt many parts of the world. One reason for this is the increase in world population, which is now growing at a faster rate than ever, mainly because of the spectacular advances in medicine and public health. It will need heroic efforts if all the people of the world are to be provided with food adequate in quality and quantity for a healthy and vigorous life. Such efforts will need to be intensified, not only in the direction of increasing agricultural production and income, but also in that of securing better distribution of food and purchasing power, especially in the underdeveloped countries. The problem of hunger provides a focus to all such efforts."

The Campaign was not altogether a new departure, but was to be "a re-dedication to the purposes of FAO", "an intensification of effort in those fields of work where FAO has the responsibility of providing guidance at the international level". However, freedom from hunger must be viewed as part of the wider problem of freedom from want, and therefore FAO had enlisted the co-operation of the United Nations and of WHO, UNESCO and ILO, all of which are concerned with promoting economic development, rises in income, improved standards of health, nutrition and education.

Objectives and Programmes

The overall objectives, in Dr. Sen's words, are to be, firstly, "better understanding of the problem of providing adequate food for the present and future world population", and secondly, "stimulating countries to take action aimed at bridging the gap".

Dr. O. H. Frankel is Chief of the Division of Plant Industry, C.S.I.R.O., Canberra.

He was a member of the Australian delegation to the 10th FAO Conference and is also a member of the Research Sub-committee for the Freedom from Hunger Campaign.

To this end, the Campaign should consist of three activities:

1. Information and Education
2. Research
3. National Action Programmes

The first of these—Information and Education—is to provide and spread information on the needs, the technical and economic possibilities, and the ways and means by which these may be realised. This programme would involve surveys of food and agriculture on a world-wide basis, similar studies within member countries, and especially in the less developed areas of the world. The Director-General proposed a series of publications prepared by the United Nations, FAO and other specialised agencies. These should include a new world food survey; texts on possibilities of increasing agricultural production, on food distribution, both international and national, on training in nutrition and efficiency, nutrition and health, population and food supplies, buying power and food, trained manpower in agricultural development, and others.

The second phase—the Research Programme—"will largely be on applied and problem-oriented projects". Originally it was in the main to provide intelligence for the action programmes, but this has since been modified; more about this below.

The National Action Programmes constitute the third, and in Dr. Sen's view the most important, phase of the Campaign. These are to stimulate or enhance vital phases of agricultural development in the less developed countries—from national food reserves, marketing improvements and credit expansion, to fertiliser pools for demonstrations, better seeds, crop protection, grassland improvement and many more. The initiative for such programmes will come from the countries themselves, but assistance from non-governmental organisations is expected to play a vital part. FAO will be ready to provide expert advice and other help in planning, and no doubt in the direction and execution of programmes, should this be required. This is the case in one of the programmes already under way, the Fertiliser Programme, which under the sponsorship of the European and North American fertiliser industries provides a fertiliser pool for demonstrations in less developed countries. A liaison officer of the sponsoring industries is located at FAO headquarters.

Initially, the Campaign is planned for the five year period from 1960 to 1965; its highlight is to be a World Food Congress in 1963.

Finance and Organization

Finance is to derive from two sources. Administrative expenses are to be met by government contributions, research and action programmes in the main by donations from non-governmental international and national organizations, from foundations, and even from private individuals.

The Director-General's estimate for administrative expenses, publications, consultants, etc. is $750,000 p.a., and for technical assistance to participating countries anything above $1-1½ million p.a., both on an average over a 5-year period.

The Campaign is directed by the Director-General and the FAO council, with an advisory committee of ten member countries. Recognised non-governmental international organizations are associated with the Campaign through an advisory council of non-governmental organizations.

These proposals were placed by the Director-General before the 10th FAO Conference in November, 1959, one of the Biennial Conferences at which member countries determine the Organization's programme and budget for the ensuing two-year period. There was general approval in principle for the Campaign, but a good deal of doubt was expressed on the question of government contributions. It was widely felt that the FAO budget was the proper place for activities which fell within the sphere of FAO. Many countries declared themselves unable to contribute for the time being, some, like the U.S.A., for reasons of existing legislation. There may also have been a feeling in some delegations that the normal programmes of FAO may to a degree suffer by concentration on the Campaign.

However, the programme was approved, in the main along the Director-General's proposals, but with reservations by many countries

as to the possibility of governmental contributions.

The Campaign Gets Under Way

The Campaign was officially opened by the Director-General of FAO on 1st July of last year. Several countries, including the Netherlands, the United Kingdom, France, Pakistan, Germany, Australia, New Zealand, and a dozen or more others, have made direct contributions to FAO. In accordance with the Conference decision, Campaign committees have been set up in many member countries.

In Australia a National Freedom from Hunger Campaign Committee, with Lord Casey as chairman, has recently been formed, which is widely representative of national organizations with interests in agricultural, humanitarian, educational or social matters, including farming, industrial, business, and professional organizations, the churches, women's organizations, and so on. The Australian Institute of Agricultural Science is represented. The committee will shortly commence its information campaign and subsequently will launch a nation-wide appeal. Much of the work will be carried out by State committees which will be similarly constituted. By agreement between the Commonwealth Government, FAO and UNICEF, the appeal will be made jointly on behalf of both these agencies, since they have kindred interests in the Campaign objectives.

More About Research

Agricultural scientists will wish to know more about the nature of the Research Programmes which are in preparation or under discussion. Several of the programmes have been started, including the Fertiliser Programme which has already been mentioned, and an "action" programme to provide grain legumes for human consumption in Nigeria. FAO has published a book containing a selection of suggested Action Programmes, which may serve to stimulate the interest of potential receptor governments and sponsor organizations. Beyond its immediate purpose this syllabus of "wanted developments" makes interesting reading for anyone concerned with world agriculture, and especially with the problems of the under-developed regions.

The research programme has been the subject of a good deal of discussion. In the first instance everyone will agree that existing knowledge must be applied wherever appropriate—i.e. within the limits of the physical and economic conditions. It may have to be adapted to those conditions through applied research, sometimes on a considerable scale. Surveys of fertiliser requirements, such as those which have been conducted in India, would be a case in point. Such projects more often than not would be of a relatively short-range nature, or could be expected gradually to be taken over by the countries themselves, for example, crop or animal improvement programmes.

On the other hand there are problems of great magnitude requiring different attitudes and different resources, problems which require long-range and/or more profound and basic research for their solution.

The Australian delegation to the 10th Biennial Conference pointedly raised this question. Its leader, Mr. J. V. Moroney, said:

> There is, however, a second and equally serious side to the question of population and food: that is the problem of the decades to come, when, as we know from United Nations estimates, the world's population is expected to double before the end of the century. Though I share the Director-General's confidence in the contributions which science and technology will continue to make to the welfare of mankind, our confidence must be tempered by the awareness of the limitations of our knowledge.
>
> "To feed 5,000 or even 6,000 million people, perhaps before too long, we must not only apply every kind of knowledge we possess, but also recognize that new knowledge of many kinds will be needed.
>
> "What are the best ways to solve the problems of those 1,500 or 2,000 million acres, mostly in problem areas, which experts tell us we shall need to feed the extra mouths? What are the most economical ways—in terms of resources and returns—of utilizing the poorer soils of the earth? What will be our fertilizer requirements, how do we conserve those in short supply; what new resources can be discovered? Can we make better use of our plants, or develop altogether new and more useful or efficient ones? Can we foresee new ways of improving human diets? And, perhaps most importantly, how do we train the numbers of workers—

no doubt several times the present number—we shall need for research, teaching and extension, to carry out these essential programmes? We have, perhaps 30 years, maybe less, in which to prepare: we must use them to the best advantage."

Both these aspects of the research programme were the subject of discussions and recommendations by members of the Research Advisory Sub-Committee, which met for the first time in October, 1960. This Committee is composed of experts from many parts of the world, with research and administrative experience in various fields of agricultural science, who were selected for their personal experience and not as representatives of their countries.

The Committee re-emphasised that the major part of the research effort should be concentrated upon research of a relatively short term nature, designed to adapt existing knowledge to local needs and circumstances; but it further emphasised

"that certain problems of very great importance should be initiated even though their magnitude and complexity are certain to preclude early termination. Here the Committee has in mind research into problems of agricultural production in the tropics, in high mountain regions where millions of people live at subsistence level, the development of new plants for human use, and others."

The Committee recommended that research be concentrated in those areas where needs are greatest, but that research organizations, universities, and others in all parts of the world should be stimulated, and if need be assisted, to take part in the fight against hunger and want, present and future, at all levels of research—from the most basic to the most applied.

The Committee compiled a long list of research projects over a very wide range of subjects which would be worthy of consideration within the framework of the Campaign. One may expect that these or similar suggestions will in due course be announced by FAO.

Throughout the report the Committee views primary production as a whole and stresses considerations of conservation of resources. It emphasises the inter-relations between primary production and economic, social and educational advancement as a whole. These interactions are to be the subject of discussions at a further meeting in which economists and other social scientists are to take a prominent part.

Personal Comment and Emphasis

1. *The inexorable urgency of population dynamics.*

Throughout the discussions and preparations for the Campaign the words "population control" have scarcely been heard. Yet the shadow of the new millions advancing, not steadily but at an inexorably increasing rate, is too solid to be avoided. The problem is formidable in every sense—scientific, technical, social, economic, political. Yet, unless it is tackled with resourcefulness, courage and determination, mankind will find itself at the turn of the century with more fully developed resources, yet no nearer to banning hunger and want. The peace of the world in the short run, and the future fate of mankind in the long run, depend on action *now*. It will make all the difference whether the population curve is to begin to level off at, say, 5,000 million or at 7 or 8,000 million.

Perhaps the urgency of the population dynamics can be put most poignantly by visualising that nearly one half of those now living will witness the doubling of the present world population.

The danger is real that the very action which is now proposed to "free the world from hunger" will even aggravate the problem for future generations, since it may generate the false impression that "science will do it for ever after". In the remarkable book "The Next Hundred Years" by Brown, Bonner, and Weir, the authors show that the predictable world population could be fed at the turn of the century adequately only if virtually all known resources of the earth were to be exploited to the limit of known techniques; this would include the bringing into production of vast areas in the humid tropics and the cold temperate zone, requiring capital resources which would be large even in terms of preparations for global warfare. Such assumptions are optimistic for many reasons, some of which are discussed below.

2. *Where should the production increase take place?*

The calculations just discussed assume that it is global rather than regional production that matters. This is scarcely justified as has been shown recently by Dr. Norman Wright in an address to the British Association at its Cardiff meeting, 1960. He shows that food surpluses are neither as large nor as transferable as is commonly assumed. Admittedly they have accumulated, especially in North America, to a level where their distribution to the underfed parts of the world, could it be effected, would bring about a marked improvement in nutrition over a short period of years. But once this has been done the annual increment would be of the order of perhaps 10 million tons as against a world grain production of well over 800 million tons, obviously a relatively insignificant amount. Moreover, surpluses occur in areas which have some of the highest population increases in the world; therefore they are unlikely to be available for ever. Hence the proper place for surpluses will be to serve as a reserve for famine and disaster rather than a normal resource to support underfed regions. It should also be remembered that the total food supplied by trade, including surplus disposals, is rather less than 10 per cent of world food consumption.

Dr. Wright concludes—and with this I wholeheartedly agree—that the main increases in food production must come in the less developed countries themselves; and since it is in these regions that population increase tends to be greatest—owing to the imbalance between death control which is being perfected and birth control which is lagging behind—the problem is not only one of agricultural production, but of the economic, social and educational development of the underdeveloped regions.

3. *New ideas and resources.*

So far we have discussed the application of existing or foreseeable knowledge and the impact it is likely to make on the food problem. But how about entirely new ideas? Mankind is in the habit of discovering the unforeseen. Without denying such possibilities, there are some resources to which we have no immediate access, but which can be discerned. To name only one or two: much has been said about malnutrition as a concomitant of undernourishment; protein deficiency is prevalent over large parts of the world. Dr. Wright, in the address I have quoted contends that the nutritional deficiencies throughout the world will not be cured by replacing of animal protein by plant protein, One would readily agree with his reasoning, but it is equally clear that the additional protein needed to feed adequately those who are now short of protein could scarcely come from animals; the task of doing so would be insuperable, at least in the most densely populated of the areas concerned. It is in those areas that leaf protein, converted into edible form, may be of the utmost significance and research on the production, extraction and the nutritional qualities of leaf protein, including possible toxicity, and on the conversion of leaf protein into attractive foods, would therefore be of the utmost significance.

Indeed, one may foresee the time when other parts of the world may be unable to spare for the production of animal feed areas which could be made to produce proteins directly usable by man.

Much more research could be visualised on the productive capacity of particular environments—especially problem environments; on the production ecology of habitats, on the conversion of well adapted but non-domesticated plants to useful purposes by chemical engineering or otherwise, and many more. As yet there is infinite scope for discovery and invention on this planet.

4. *The nature of research in less developed countries.*

It is often taken for granted, especially by representatives of less developed countries, that for some time to come any research should be devoted directly to development and that it should apply existing knowledge rather than investigate basic facts and relationships. This, I believe, is dangerous if it goes as far as to exclude all basic endeavour. Social and mental habits are hard to change and a generation brought up in pragmatism teaches the next one likewise. Difficult though it may be in the face of desperate urgency and political pressure,

I contend that basic thinking and basic research must indeed be part of the technical and scientific development in those countries. It is here that academic and scientific institutions elsewhere could give the most powerful moral and material aid.

5. *Contribution of Australian agricultural science.*

It seems to me that Australia has the opportunity of making a powerful contribution to the purposes of the Campaign, arising from her geography and history. Australia has developed almost within living memory, large parts of a continent with a great variety of difficult environments. She has developed strong schools in science and agricultural science and effective research institutions in a wide range of relevant fields. Australia's workers have acquired knowledge and experience in many fields of great relevance to the advancement of the less developed countries: assessing the land-use potential of underdeveloped country, large scale mechanical land clearing methods, mineral nutrition of plants and animals, the introduction and adaptation of crop and pasture plants, sheep management for wool and meat production, large scale animal disease prevention, water conservation techniques, and many more. Our workers tend to be adaptable in dealing with new problems, different environments and all kinds of people. I am suggesting that contributions in terms of scientific manpower, brain power, experience and knowledge would be Australia's most effective contribution.

Such a contribution could take many different forms, too many to enumerate, from training in our universities, which is now commonplace, to help in establishing universities and institutes in the less developed countries themselves. There is an infinite variety of ways in which help and encouragement can be given at a personal level: seminars, training schools, short or long term visits in Australia; in reverse, short or long term tours of duty by Australian University, research or extension personnel singly or in teams in the less developed countries. All this happens today, but it could be diversified and multiplied many times over.

This may come as a strange suggestion from one who is well aware of the difficulties of staffing scientific institutions Australia needs for her own development. But the world situation which the Campaign endeavours to highlight compels us to think afresh. It may well be that every man or woman who helps in the development of the under developed countries contributes more to the prosperity and peace of Australia's coming generations than were he to aid the development of his own country.

6. *Perspectives.*

It is an ironical juxtaposition that at a time when man has found the way into space at a cost in human and material resources unprecedented in any other scientific or technical development, and when virtually limitless resources are available to explore the worlds around us, one should find it necessary to campaign for freeing our own world from widespread hunger. Nor is it less ironical that the sums which FAO hopes to raise in this campaign should be of an order of magnitude which no self-respecting space research team would regard as much more than pocket money.

But let us not underrate the force of ideas. Dr. Sen, who is not only a man of great power and vision but a realist and experienced public servant, knows full well that once a start is made which strikes the imagination of the people of the earth his endeavour will magnify, branch out and snowball till it comes much nearer to fulfilment than can even be hoped for today. He knows equally well that words are less convincing than action, and action less than success. A successful beginning in the Freedom From Hunger Campaign 1960/65 may succeed in 25 years' time to conquer hunger and want. It is in this perspective that the Campaign wants to be viewed and, I earnestly feel, supported.

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AGRICULTURAL POLICY IN ITS ECONOMIC SETTING

J. G. CRAWFORD

Introduction

1. Is there an *Agricultural Policy?*

Many actions of Government affect agricultural production and marketing. Since policy is "a course of action" (O.E.D.), a description of these actions is tantamount to a description of policy.

Except in time of war it has not been usual for Governments to draw up a policy in comprehensive terms and then to formulate legislative acts within that framework. Yet in 1952 Mr. McEwen's statement to the Australian Agricultural Council was just this—I quote part of it:

> "The Commonwealth Government has, therefore, decided to adopt as its policy objective a Commonwealth-wide programme of agricultural expansion, not only to meet direct defence requirements, but also to provide food for the growing population, to maintain our capacity to import, and to make our proper contribution to relieving the dollar problem.
>
> "Out of a consideration of all these circumstances the Commonwealth Government has decided that activities directly concerned with the production of essential items of food and agricultural products in this country shall be classified in importance with defence and coal production."

This policy grew out of the clear evidence in May 1951 that agriculture was not recovering from war and drought, and was not successfully competing with secondary industry for scarce resources. The response was good and to-day only the "maintenance of capacity to import" receives much emphasis. This was more or less true of Mr. McEwen's address to this Institute in October 1959. It will have an important place in what I say later. Nevertheless it should not be assumed that agricultural policy is necessarily comprehensive, or that it is always economic in its emphasis. Thus many people favour policies designed to sustain farm population for social reasons such as putting a brake on over-urbanisation, occupying vast empty spaces, and so forth. This kind of motive has certainly been of some importance in Australia.

In short, agricultural policy may not be capable of internally consistent rationalisation: it is likely to be a collection of attitudes and measures not always adding to a whole of homogeneous quality. It is possible to select facets for special treatment.

2. *Economic Setting*

This last comment is hardly less applicable to the other part of the title of my address—the "economic setting."

For a mixture of motives of the social and political kind mentioned earlier, the community may support a vast array of measures in order to ensure that the well-being of farmers is consonant with standards enjoyed in the rest of the community. Most people would consider it right that telephones, television, radio, hospitals, schools, and medical benefits should be available to rural population, even if the costs of supplying them are higher than in the cities. Price support schemes, such as The Dairy Stabilisation Plan, receive considerable support on grounds of fair play in the sense of considering that parity of income should somehow be achieved. It is widely recognized, again, that our tariff policy presents some disabilities which justify some preferential treatment to farmers as, for example, in taxation

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This article comprises notes used for an address to the A.C.T. Branch on April 6, 1961.

depreciation allowances. There is recognition that farmers are subject to hazards of fortune which most in the community escape.

All these aspects would justify an approach to my subject in terms of agriculture's share in the national economy—percentage of work force, percentage of national income, whether it leads to inland population centres of importance and a host of other questions, not excluding whether agricultural output is now growing commensurately with the food needs of our population. This last, of course, was a proper question to ask in 1950. We could be interested in the story of soldier settlement and civilian settlement prospects, as for example, in Northern Australia. All these matters have some bearing on the economy, but they are not my real interest here.

I intend to return to an old theme—the relationship of agriculture to our economy, which arises from its role as principal export breadwinner.

Export Needs

My usual line of argument has been that Australia is striving to grow in economic and population terms. It wants full employment, it wants to develop its resources in ways which will not only support growing population but which will provide rising living standards. We are not able to operate in a closed economy—I need only to mention oil. In fact, an open economy is necessary in order to give us access to needed imports. Moreover, if we didn't export there would be much of our rural resources not usable for many years to come. This could aggravate urbanisation. Because of our comparative advantage in most basic primary products it pays us to export, and so finance imports we must have or which it pays us to have.

Out of this situation and the fact that primary products account for about 80 per cent of our exports, there are two propositions worth looking at:

I. Agricultural exports must be sustained;
II. Agricultural exports must be expanded.

There will be little argument about Proposition I, since no one I know really expects long term import needs (e.g., next decade) to fall very significantly. (Always excluding a major oil discovery and even then the proposition might still hold). No one expects manufacturing exports to take over a very much larger share of total exports over-night. There should be a steady rise in manufacturing exports, but not enough to invalidate Proposition I.

There may be little argument about this but this does not mean there is no difficulty. Anyone familiar with the way our terms of trade* have fallen in recent times will be aware of the difficulty of trying to mount the down escalator—i.e., keeping quantity x price or total value constant. Yet this is what we need to do, for import prices do not fall and total value of imports required doesn't fall either. So Proposition I may, and does in fact, present us with a number of policy worries. Proposition II may present them in more acute form. Let us look at Proposition II by examining Table 1.

Observe how difficult it is to project. Also note that I am not talking about 1961-62, whether we need import licensing or not—although it is clear that 1960-61 cannot be allowed to repeat itself! Note in particular the following items we need to know:

(a) The basic need for imports at a given level of G.N.P.—i.e., what is *basic* in the 1960-61 figure and what rate of change thereafter.
(b) Whether "invisibles" will vary roughly proportional to imports.
(c) Whether capital inflow can be sustained. If this disappeared some reduction of imports would occur but not £225 m.! We are becoming very dependent on sustaining a high *net* inflow if we are to avoid more drastic policies than any yet tried.

Given the assumptions I have made, exports may need to be just under £1,000 m. or up to nearer £1,300 m. By being pessimistic about capital inflow the situation could be made worse. It could be made better only by assuming greater capital inflow or that "import saving" will match all the increase in imports otherwise needed. I think this unlikely but I can only ask the question I asked the Society of Agricultural Economists in February, 1959: 'Does anyone really know the answer?' Until

*Ratio of E (export prices) to I (import prices).

TABLE 1

Hypothetical Balance of Payments Situations.

	1960-61	1965-66		
	£m.	(a)	(b)	(c)
Exports	880	990	1,045	1,280
Imports	—1,080	—985	—1,030	—1,220
Trade Balance	—200	+5	+15	+60
Net invisibles	—250	—230	—240	—285
Current A/c. Balance	—450	—225	—225	—225
Net Capital Inflow	225(e)	225	225	225
Change in Reserves	—225	—(d)	—(d)	—(d)
(Becoming 287 at June 30th as against 512 last June)				

Notes:

(a) Basic import need in 1960-61 taken as £950 m. or 13% of Gross National Product. The figure £985 m. is obtained by assuming G.N.P. to grow 5% per annum, but import needs to drop from 13% to 10½% of G.N.P.—i.e., ½% p.a. "import saving".

(b) Basic import need in 1960-61 taken as £1,000 m. (13½% of G.N.P.) with ½% p.a. "import saving" as before.

(c) No import saving, import needs rising *pari passu* with G.N.P. from £950 m. to £1,220 m.

(d) It is most important to note that no allowance has been made for restoring reserves. Is this necessary? Will a rise in "terms of trade" do this between now and 1965-66.

(e) Since this table was presented there has been a considerable increase in capital inflow including drawings on the International Monetary Fund. The position at June 30, 1961 will be much less serious than we assumed. This fact does not alter the relevance of the questions asked on the basis of the Table. (Author's note).

someone does I prefer to assume a steady but not exaggerated increase in import requirements for some years to come; provided we sustain recent rates of growth in the economy.

This means that Proposition I is easily answered and that Proposition II probably ought to be answered in the affirmative.

Some Policy Problems Arising from these Propositions

Let us ignore—but only for the present—the question whether manufacturing can relieve the situation. There are two broad policy areas for consideration—the external market situation and the internal cost situation. The third area, production policy, rather grows out of these two.

On the *external* side there are some 'knowns' and many 'unknowns'. We know, for example, that we are up against a brick wall in Europe and U.K. for wheat; but what of wool and meat? Japan is proving valuable for many of our products. The U.S. continues to disappoint except for meat. India is still a problem for wheat and who can say China has come to stay? And so one can go round the world and conclude that markets are difficult for this and that reason. Our terms of trade are down nearly 20 per cent on pre-war years and about 35 per cent on 1952-3: we ought not to count on any rapid restoration. All this is reinforced by certain general things we know—industrial trade has been growing much faster than trade in basic primary commodities; Europe is very unwilling to modify protectionist policies; many countries are in balance of payments difficulties and must give preference to imports of capital goods (especially if U.S. 'Public Law 480' supplies are available).

In a situation like this external policy is clear: compete as hard as we can in those markets open to us—in quality, regularity of supplies, and price. Use promotion if this offers a useful aid. Make Trade Treaties to hold and expand openings. Reach understandings about

PL 480. Why not think of a little retaliation where the G.A.T.T. bargain is too one sided as, for example, in Germany? Wool is still basic and here I have no reason to change previous views—reduce costs, increase promotion and increase research in the production and uses of wool. But now I begin to come back within the national scene.

Internally it is proper to record the magnificent production record since 1951-52. But for this the farm income position would be vastly worse than it is and, moreover, so too would be our external situation. Productivity has been preached as an answer and, thanks to science, extension, good seasons, and application by farmers, the response has been good.

Yet is enough being done? Is the total of agricultural policy consistent or homogeneous? Are not external factors making it too tough for agriculture?

Rising productivity per farm unit (defined in terms of capital, labour and land) is one way to keep costs down. But the question is being asked: Isn't the race being lost? Those who ask the question are aware that much in a farmer's costs arise externally to his farm, for example, general inflation of costs. This inflation, if mild, isn't necessarily unbearable for the non-export part of our economy. If less than that of other countries it may be supportable. If productivity rises faster than costs, it may be bearable (remembering that we need to watch our competitors.) It is really difficult when productivity does not offset rising costs, or when added output meets with lower export prices (as recently), or when the inflation is worse than that occurring in the economies of our competitors and markets.

Now a difficult situation doesn't call for changes in research and extension efforts—it accentuates the need. It does however raise the question whether measures like fertilizer subsidies, or special credit assistance should be reconsidered. For some a much bigger question is raised: why not devalue? It is a tricky issue and a fair question. I say at once I do not favour it as a remedy for short-term balance of payments difficulties. As a device for improving the farmers' cost/price position it has much appeal. But I urge caution about it. It would certainly improve Australian incomes of exporters in the very short term, and this may well encourage more production. What we do not know is whether prices would fall more than production would expand. This is the wretched question of inelasticity of demand and of elasticity of supplies (including those of our competitors.) We cannot guarantee that overseas prices will not fall as production expands further. Again we cannot guarantee that another wage/cost spiral won't start if we depreciate exchanges. Will we shortly face the need of another depreciation, simply to achieve the same short term benefit again? If we do, what happens to that critical item, "capital inflow"? Exchange depreciation has a case but I would counsel against it in present world and domestic circumstances.

It seems then that what I favour is more of the mixture as before—research, extension, some assurances about incomes (wheat and dairying) and perhaps selected subsidies, such as for fertiliser, where these are related to investment. I strongly favour marginal farm reconstruction as recommended by the Dairy Committee and hope this cause is not lost. I also believe the Government is right in paying attention to port facilities and inland transport conditions.

Conclusion

Since I have no universal panacea I care to recommend, I cannot blandly assume that agriculture will necessarily respond successfully in terms of Proposition II. Controlling inflation in Australia, recovery from depression in North America, and more Treaty negotiations will all help sustain agriculture. Research and extension will continue to help with costs and therefore with net returns.

Nevertheless, to lift total exports to £1,100 m. or £1,200 m. may prove beyond agriculture in the circumstances of world markets over the next five years, even with 10 to 15 per cent price recovery. This brings me to my final two points about our economic setting:

1. It is no use exhorting the farmer to grow more—this has always been a risky policy. But we can exhort and help him to invest if there is room for profitable investment—as there will be if added returns (taken at low

prices) exceed added costs. It is in this connection that members of this Institute have a role to play, no less important now than it has been in the past.

2. If the demand for our exports is sluggish in the sense that it is not expanding fast enough, then it makes good sense and good theory to develop other exports (e.g., steel products and processed minerals) and import savers. Import savers include some agricultural crops, it will be noticed. We have a comparative advantage in wheat, wool and meat, but this doesn't necessarily mean that a policy of unlimited production in these items will pay the nation better than more exports of manufactures and more import savers. In practice a mixture of cautiously pushing forward in agricultural exports (e.g., meat in many markets, wool in Japan) and developing *new* exports is probably the right policy.

But once I leave agriculture I begin to leave my subject. Let me sum up.

i. Agricultural policy can be directed to many objectives, social and economic.

ii. In the economic setting of today Australian Agricultural policy is directed principally towards facilitating the right import policy.

iii. This approach calls for vigour in pushing overseas markets and a many sided policy at home. It justifies the consideration of new ideas and new measures; but I am sceptical of panaceas. Moreover, nothing replaces the investment decision to be made by farmers themselves; but credit policies, research programmes and lively marketing can help the right decision.

iv. The situation in Australia probably calls for expanded exports or a reduction in imports brought about by "import saving". In this process agricultural expansion is not excluded but the ratio of manufacturing to agricultural effort ought to rise.

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AGRICULTURAL SCIENTIST

A vacancy exists with McLennan & Co. Pty. Ltd., Mooroopna, Victoria, for an Agricultural Scientist.

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Letters

Aircraft for Extension Work in Pastoral Areas

The Courier Mail reported on the 19th August, 1960, that Queensland was entering its greatest 'Fly-it-yourself' boom. The article told how 80 light aircraft had been ordered by graziers and other operators.

The State's total of light plans was 260 on August 1st, 1960.

Frequently we read stories about the part played by light planes in Flying Doctor work throughout Australia. Gradually the use of aircraft has spread to other professions. An optometrist in Longreach has increased his business greatly since purchasing an aircraft; he can spend the morning in one town, the afternoon in another and be back in Longreach for dinner. Theiss Bros. put a value on the travelling time of their engineers and have their own aircraft to take them where they want them when they want them. A Catholic priest in Western Australia used to hold a six o'clock mass in Port Hedland, flew his Tiger Moth to Roebourne one hundred miles down the coast for a second service, and sometimes one hundred and forty-five miles down to Onslow for a third.

These professions are using aircraft for efficient transportation, and it is worthwhile to see if the light aircraft has anything to offer for the agriculturist for extension work in areas of Queensland where distances are great.

TABLE 1

From	To	Road Miles	Air Miles	Saved Miles	Road Hours	Air Hours	Saved Hours
Munda	Abydos	144	85	59	6	1	5
Munda	Pardoo	125	108	17	5	1¼	3¾
Munda	Pt. Hedland	60	40	20	2	½	1½
Abydos	Pt. Hedland	92	80	12	3¼	1	2¼
Abydos	Coongan	189	83	106	6	1	5
Abydos	Croydon	199	75	124	8	1	7
Abydos	Pardoo	162	106	56	6	1¼	4¾
Pt. Hedland	Pardoo	83	80	3	3	1	2
	Totals:	1,054	657	397	39¼	8	31¼

TABLE 2

Hypothetical costs of travelling 11,000 *miles a year.*

		Car	Tiger Moth	Cessna 172
Travelling time	(hours)	410	83	60
Cost of travelling allowance of 4/1 an hour	(£)	83.4	16.9	12.3
Salary at £1,300 a year	(£)	271.6	55.0	39.7
Annual fixed cost of vehicle	(£)	137.5	163.0	400.0
Annual operational cost of vehicle	(£)	264.0	211.6	121.8
Total cost	(£)	756.5	446.5	573.8

In 1952, an International utility was purchased for extension work in the North West pastoral areas of Western Australia by the Author. In 1953, an aircraft (Tiger Moth) was operated by the Author for extension work in the same area, over many of the same routes as the utility.

The differences in time and mileage, for all trips where these figures can be given for both car and aircraft, are shown in Table 1.

What these savings in hours and miles would represent in money in Queensland for a similar type of work is shown in Table 2.

In estimating costs the following assumptions have been made:

1. The costs of operating a motor vehicle in Western Queensland for 11,000 miles a year be considered as follows:—
   Operational costs .... 5.76d. a mile
   Fixed costs .... 3.00d. a mile
2. The savings in miles and hours by air travel in the pastoral areas of Western Australia would be about the same in Queensland.
3. The costs of operating a Tiger Moth aircraft in Western Queensland for $657 \times \frac{11,000}{1,054} = 6,857$ miles could be considered as follows:*
   Operational cost .... £2.55 a flying hour
   Fixed cost .... £163.00 per annum
4. The costs of operating a Cessna 172, four seat aircraft in Western Queensland for 6,857 miles could be considered as follows:*
   Operational costs .... £2.03 a flying hour
   Fixed costs .... £400.00 per annum
5. We can put a value on each hour spent by an extension officer, i.e. in terms of the number of properties visited in a year, the changes he has brought in his district, and the number of other activities he has been able to undertake.

J. R. M. WOLFE

Information Branch,
Department of Agriculture and Stock,
Brisbane, Queensland.

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*Toft, H. I.—Does it pay to use a plane on a grazing property? *Qd. Agric. J.*, **86**, 249.

Graduates in Extension Work in Victoria

Members of the Institute will have read with interest and approbation the announcement by Professor L. J. H. Teakle in the March 1961 number of the Journal that a Senior Lectureship in Extension Methods is to be established in the Department of Agriculture of the University of Queensland. Introducing the announcement, Professor Teakle said—

"For the last 50 years, there has been a glamour about research, and the attraction to the research field does not wane—may it never do so.

"On the other hand, there has been little call for University graduates to enter the agricultural extension services in Australia. Only in the Department of Agriculture in Western Australia has it been the settled policy to use University graduates for extension work; in other States this field has been generally considered more suitable for the College diplomate. While College diplomates have given splendid service in the past, the future seems certain to bring increasing demand for University graduates in the extension service and it is time Universities prepared their students for this work."

Victorians and many others will know that, for many years, it has been the settled policy of the Victorian Department of Agriculture to use University graduates for extension work. This policy was consolidated by a decision of the Government in 1945 to place in the country District Agricultural Officers with scientific

qualifications and possessing a University degree in Agricultural Science. The objective then set was an establishment of 24 such positions scattered throughout the State, and 33 scholarships at the Melbourne University have been awarded (financed by the Commonwealth Extension Services Grant) since 1954 to provide graduates with a scientific background for a career in agricultural extension work. In their early years of service with the Department, they are classified as Agricultural Extension Officers, and receive the same scale of salaries as research officers.

In the period 1945-1948, a Senior District Agricultural Officer and seven District Agricultural Officers were appointed, all experienced graduates in agricultural science and who had previously been engaged primarily on experimental work.

The Department now has on its strength 6 District Agricultural Officers and 17 Agricultural Extension Officers, whilst 6 undergraduates with extension scholarships are at the Melbourne University. In addition, extension work is energetically performed by Agricultural Science graduates classified as Agronomists, Agrostologists, Sheep and Wool Officers, Livestock Science Officers and in several other categories.

The policy outlined above has been most successful and will be continued, with such improvements in postgraduate and in-service training as can be arranged.

For the past several years, strong emphasis has been placed on organized in-service training in Extension Method by the Victorian Department of Agriculture, and it has been availed of by both full-time extension officers and by those who perform in the regular course of duty both research and extension work in their field.

I am sure Professor Teakle will welcome this letter and regard it as support to his plea for better training of people for extension service.

W. B. MILLER.

Department of Agriculture,
Melbourne, Victoria.

Buffel Grass in South-western Queensland

Buffel Grass germinated well after being sown under dry conditions on a red sand in a Eucalyptus populnea *association. An abnormally wet period of six months then ensured a satisfactory establishment of plants. No fertilizer was used.*

During a four-year drought the grass persisted well, both grazed and ungrazed. Subjective assessments indicated that there was no significant plant mortality although native perennial grasses nearby died.

Introduction

Buffel Grass (*Cenchrus ciliaris*) is a summer growing perennial grass which has increased in importance because of its potential as an

TABLE 1

Monthly Rainfall Totals at "Gilruth Plains" 1955-1960.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1955	447	465	117	176	132	30	126	169	10	213	134	16	2,035
1956	373	630	1,011	29	173	221	341	0	65	123	26	200	3,192
1957	72	121	245	85	20	161	13	3	0	28	3	26	777
1958	124	9	40	141	31	206	10	54	52	54	199	72	992
1959	273	130	41	317	163	93	31	0	42	76	17	32	1,215
1960	118	195	0	0	112	100	71	41	201	3	215	50	1,106

introduced pasture plant in many lower rainfall areas of northern Australia. There are numerous strains, the best known including Gayndah, Molopo, Biloela, and the Western Australian strain. This note relates to the performance of the Gayndah strain under

TABLE 2

Performance of Buffel Grass, 1956-1960 *on a Red Sandy Soil.*

Date	Seasonal Conditions	Performance of Buffel Grass
1956		
January	373 points	Active growth of existing plants but no further germination. Flowered in February.
Winter	Frost	Plants severely cut.
September	65 points	Plants growing well at end of September.
October	123 points	Plants growing actively, being distinctly greener than any of the surrounding native species.
1957		
February	121 points	Plants flowered in March after growth following this rain.
August	Drought	Buffel Grass the only grass, native grasses included, making active growth and not deteriorating in the drought. Again considerably greener than any other grass species.
1958		
March	Drought	Ungrazed plants in good dry condition, with traces of green in the centres of the butts. Grazed plants had been eaten to ground level.
April	141 points	All plants, both grazed and ungrazed, grew well and flowered.
December	Drought	Grazed plants eaten to ground level. Nearby native perennial grasses on same soil, including some *Aristida spp.* had died out by this time.
1959		
January	273 points	These falls constituted a drought relief rain. All
February	130 points	plants recovered, grew and flowered after this rain.
July to December	Drought, 198 points	Plants persisted.
1960		
January	118 points	Both the grazed and ungrazed plants grew well, and then died back.
February	195 points	Plants again grew vigorously and flowered after this rain.
Winter	Drought	All plants dried back to butts in a dry winter.
1961		
January	328 points	Both grazed and ungrazed plants grew actively and flowered following this drought breaking rain.

natural rainfall and without fertiliser in south-western Queensland.

Soils and Rainfall

In September 1955 three plots of the Gayndah strain were sown on different soil types. Soil conditions at sowing were dry. The soil types were:—

Plot 1. A red sand in a sparsely timbered box (*Eucalyptus populnea*) association. This association bordered a sandhill with native pine (*Callitris hugelii*).

Plot 2. A brown sandy loam on a stony ridge in an association of mulga (*Acacia aneura*) and box.

Plot 3. A light grey sandy clay in a gidgee (*Acacia cambagei*) association.

The rainfall recorded since 1955 is given in Table 1.

Establishment

The plots were cultivated with disc harrows, and seed was sown broadcast onto each plot on September 22, 1955. Plot sizes approximated 60 yards by 2 yards.

Rainfall from sowing until the end of October was: September 23, 5 points; October 8, 81 points; October 12-18, 18 points; October 20-30, 114 points.

On October 18 a light germination was observed on Plot 1, very little germination on Plot 2, and none on Plot 3. By the end of October the overall germination on Plot 1 was fair, on Plot 2 fair to poor, and on Plot 3 nil. By the end of December there were plants visible on Plot 1 only, and these were suffering from the dry conditions.

An extremely high rainfall during the first half of 1956 enabled the plants to become strongly established, however, and no doubt contributed to their persistence in the ensuing drought.

Persistence

Half of Plot 1 was fenced from sheep, half was left open to grazing by sheep and kangaroos. The performance of the plants in Plot 1 for the period from 1956 to 1960 is summarized in Table 2.

Throughout this period, existing plants repeatedly showed an ability to respond quickly and grow vigorously after a prolonged dry period.

No spreading of the grass from its original planting site has been observed.

C. H. S. DOLLING
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Received for publication February 8, 1961.

Book Review

The Soil under Shifting Cultivation

By P. H. Nye and D. J. Greenland

Commonwealth Bureau of Soils, Technical Communication No. 51, 156 *pp.* + 8 *plates. Obtainable from the C.A.B. Liaison Officer, at* 314 *Albert Street, East Melbourne, C.*2., *Victoria. Price* 25/-.

This Technical Communication is a bound book attractively put together. Like many of the series it collects information that is otherwise not easily available. The "shifting cultivation" is that of the more primitive cultures of Asia, Africa and America, in the equatorial and monsoonal climates. The native vegetation may be anything from dense forest to savanna, with accompanying rainfall ranging from over 70 to 35 inches annually. In all cases the human use of the land is to burn, to sow or plant crops on the ashes, to continue cropping for a few years until cropping becomes too difficult, then to leave the land to revert to its original cover and to move on somewhere else. The authors, who are both on the staff of the University College of Ghana, evidently know their subject at first hand, and they have made an expert summary and review of the information. There are 13 pages of references.

Nye and Greenland are writing in the first place for those interested in the 200 million people, scattered over 14 million square miles, who obtain the bulk of their food in this way. Their book is essential for anyone directly concerned with shifting cultivation. But it should also appeal to a wider field, including the soil specialist and the agriculturist. The authors give many figures and calculations (which are relevant also in temperate climates) for the cycles of carbon, nitrogen, calcium, potassium and phosphorus, and incidentally dispose of the mistaken belief that the organic content of tropical soils vanishes with cultivation.

Nye and Greenland believe that shifting cultivation does not generally damage the soil greatly, whether by depleted fertility or by erosion. The cultivator abandons the land not so much because of lower fertility as because he cannot control the weeds, especially *Imperata cylindrica,* a worldwide curse of the tropics.

THE UNIVERSITY OF SYDNEY

CHAIR OF SOIL SCIENCE

Applications are invited for a newly established Chair in the Department of Agriculture, the Chair of Soil Science. Salary will be at the rate of £4,250 per annum, plus cost of living adjustments (at present £42 p.a.). There is retirement provision under either the Sydney University Professorial Superannuation Scheme or the New South Wales State Superannuation Scheme. Under the Staff Members' Housing Scheme, in cases approved by the University and its Bankers, married men may be assisted by loans to purchase a house. The Senate reserves the right to fill the Chair by invitation. A statement of conditions of appointment and information for condidates may be obtained on application to the undersigned, with whom applications close on 23rd August, 1961.

Sydney,
June, 1961.

M. A. Telfer,
Registrar.

Talks

Farm Management Advisory Services and the A.I.A.S.

Dr. H. P. Schapper, Reader in Ag. Economics at Institute of Agriculture, University of W.A., in an address to the W.A. Branch.

In Western Australia there are now five Farm Management Advisory Services—at Brunswick, Pinjarra, Margaret River, Manjimup and Quairading—and four more are likely to be in operation shortly. A firm of accountants also runs a Farm Management Consulting Service for its farmer clients.

Features of Farm Management Advisory Services are—

1. Farmers pay directly for what they get
2. The service is personal and intensive
3. It is directed specifically to financial outcome on the farm
4. It uses a whole farm approach.

These features are the basis of establishment and development of private practice in professional agriculture. They can be contrasted with farmers' contracts with professional agriculturists or institutions such as the Departments of Agriculture.

It appears that the Farm Management Advisory Services will become a permanent feature of agricultural extension, and a large scale movement seems likely.

Of what concern are the Farm Management Advisory Services to the A.I.A.S.? There are several possibilities—

A. The A.I.A.S. could see them as an alternative to traditional avenues of employment—a private practice avenue. This could be seen as an indirect source of pressure for the needed improvement of conditions in the Departments of Agriculture as suggested in the report "Agricultural Scientists in Australia", but if the services employ only diplomates as their advisers, this may not be true. Clubs in Western Australia are appointing New Zealand Agricultural College diplomates but it would be wrong to see this as a definite permanent trend, because firstly wherever there is a sudden demand there is a tendency to use marginal resources; and secondly University agricultural graduates are organisation conscious and have never thought of private practice as an outlet for their services. No doubt this will change.

B. The A.I.A.S. may have some professional concern that these could become seond rate services, but it is unlikely that second rate services would last. In private practice the remedy for poor service is swifter and surer than in any organisation.

C. The fact that farm management advisory service advisers are not eligible for A.I.A.S. membership is of little importance to the advisory service movement because at present A.I.A.S. membership confers no status, prestige or economic privilege.

D. It would be a good thing if the A.I.A.S. could be represented on committees of management of all farm management advisory services.

The advisory service movement certainly appears to be developing on a strong base in Australia, and it seems not unlikely that Departments of Agriculture and A.I.A.S. members will have to get used to the idea that another set of organisations is making itself responsible for agricultural extension.

In the not too distant future, we may see a change in emphasis of the work of the Departments of Agriculture towards less extension and more research, and it may be that the Departments will be to advisers in the farm management advisory services what C.S.I.R.O.—through its liaison service—is now to the Department of Agriculture officers.

The Role of Agricultural Science in the Australian Economy

Mr. C. W. Strutt, Assistant Secretary of the Department of Primary Industry in an address to the Western Victorian sub-branch.

Australia had to deal with a serious fall in overseas funds during the past 12 months. Among the steps necessary to correct this was a substantial increase in the exports of both primary and secondary products.

One of the measures required to achieve this was a reduction in costs of primary production, and this could be done by a combination of research, extension and application.

Under various joint Commonwealth and primary industry research schemes, there was now available for research and extension work in Australia about £3,400,000 a year.

In five major forms of production—wool, wheat, dairy produce, meat and tobacco—extensive programmes of research were now being undertaken.

The provision of the £3,400,000 by the Commonwealth and the primary industries themselves meant that research could be started on work for which funds were not available up to five years ago.

Quoting examples of the value of this research expenditure, he said that tobacco production had increased from 2,739 short tons from 12,332 acres in 1955-56 to an estimated 15,558 short tons from 30,183 acres this season. Production per acre had grown from an average of 750 lbs. in the five year period ended 1955-56 to an estimated 1,030 lbs. this season.

Speaking of wool research, Mr. Strutt said the latest development was the discovery of a process for producing "wash and minimum iron" woollen garments. This was of very great importance, and would probably have a significant effect on the demand for woollen wear, especially for children.

After detailing the various new processes that had been developed through research, he commented that the problem now is to get these results over to the manufacturers of woollen and worsted material and to the public.

The development of the various research programmes had increased the demand for trained men, and an increasing number of graduates in agricultural science was now coming from the universities. The total had grown from 70 in 1955 to 143 in 1960, plus nine trained in rural science and two in wool technology.

In Search of Quality

Mr. J. C. M. Fornachon, in his presidential address to the South Australian Branch.

The quality of wine depends on, firstly, the freedom from obvious defects in colour, clarity, aroma, flavour and taste, and secondly the presence and amount of desirable aromas, flavours and tastes and the balance between various constituents.

Although consumer preference studies give valuable information concerning the popularity of different styles or types of wine, quality is usually assessed by small panels of expert taster. Various physical and chemical tests can also provide valuable supplementary information for the winemaker.

The factors which influence quality were discussed under the headings:—

(a) The quality of the grapes.
(b) The methods of making and maturing wine.

From very early times, attempts have been made to improve the quality of wine by various means, but until recently the chief concern of research workers has been to prevent spoilage and to detect and prevent adulterations. This negative approach has undoubtedly led to marked improvements in quality in the past, but a change in outlook is now apparent. There is now increasing interest in production of wines with more and better flavour, representing a more positive approach to the search for quality. This attitude is seen in such recent developments as controlled fermentation for making white table wines, control of the flor process for maturing sherry and current researches on the malolactic fermentation in table wines. Further advances of this kind are likely to depend on more fundamental investigation of the processes involved in making and maturing wine.

Viticultural research in the past has been concerned chiefly with combating various diseases and pests of the vine and with improving the yield of grapes, but increasing attention is now being given to the wine-making quality of grapes. It is widely believed that the winemaking quality of grapes depends primarily on the variety and the soil and climate in which the grapes are grown. This relationship is at present under investigation in Australia and various means of obtaining more and better varieties of grapes are also being explored.

The Indonesian Council of Sciences

Professor Sarwono Prawirohardjo, President of the Council for Sciences of Indonesia, spoke to C.S.I.R.O. staff at Canberra recently on "The Scientific Development of Indonesia".

This nation of 92 million people scattered over 3,000 islands had 3 centuries of Dutch rule followed by 3 years of Japanese military occupation. It is only in the past 15 years that the nation has been self-governing, of which the first five years were taken up with an armed struggle to preserve independence. Thus there have been virtually only ten years for development and improvement of many national aspects.

Science in Indonesia has a relatively long tradition. The Society of Arts and Sciences for East India was established in 1778 and the Botanic Gardens at Bogor in 1817. By 1920 there were 5 schools of higher education including engineering, law, medicine, and agriculture, with 1,700 students.

However university training was almost entirely limited to the Dutch.

During the Japanese occupation and the unsettled period following there was a decrease in research and teaching and isolation from the outside world. Moreover, the Dutch scientists who had been imprisoned during the war eventually left Indonesia. The environment for scientific research and training therefore was most difficult.

During the past ten years however many new scientific laboratories have been built and there are now 53 such institutions and the number of universities has been increased to 8 with a total of 49,000 students in 1960. This development has been greatly assisted by foreign aid particularly from the U.S.A. An increasing amount of help is coming from Australia.

The Council for Sciences was formed in 1956 and deals with the fields of natural and cultural sciences. It takes precedence as the highest national scientific organisation. The 8-year national reconstruction plan which will spread over the years 1961 to 1968 has been given serious consideration by the Council. As part of the Plan the Council has provided for facilities for long range investigation of Indonesia's physical resources. The Council is also responsible for long term planning in scientific research and in the policy for provision of training centres and research establishments. It is possible the Council may need to build its own research laboratories.

The text books in use in training are mostly in English whilst English is taught through the six years of secondary school. The Council has decided not to make text books in the Indonesian language until more local knowledge and statistics are available.

Apart from the problems in physical establishment of laboratories the most vital problem is the lack of scientific manpower. Most of the senior men are now approaching retirement and while the past ten years of training have produced fairly adequate numbers of young graduates there is a gap to be filled. One suggestion for filling this gap is to have short term visits by foreign senior scientists whose opinions would be of value to Indonesia's science. Another desirable approach, but one more difficult of attainment, would be for senior scientists to work in Indonesia for a period of 4 to 5 years.

Soil Conservation Extension Services

Precis of Presidential Address, April 17, 1961, by Mr. H. R. Dickinson to the Victorian Branch.

The Soil Conservation Authority is responsible for research and advisory work on soil conservation in Victoria, and operates within the provisions of the Soil Conservation and Land Utilisation Act.

The Authority is organized in five divisions: field (or extension), research, engineering, publications and information, and administration. There are fifteen conservation officers in country districts as well as the city staff. A lot of the district officers are diplomates, who are given comprehensive in-service training to fit them for district work.

District advisory committees exist in soil conservation districts to advise the Authority on district needs. These committees are composed of representatives of Government Departments as well as local landholders, who are always in the majority. Usually, the local district officer is secretary.

It is a characteristic of advisory work in soil conservation that personal contact is necessary to give advice that can be readily applied. Consequently the main aim of district officers is to give their advice on the farm and to assist farmers to draw up plans to effect soil conservation.

Apart from farm visits, the S.C.A. runs district soil conservation competitions. The associated field days have done much to instruct farmers on soil conservation. Extension work is also done through the schools, film nights, and lectures to various bodies.

The Authority always endeavours to obtain cooperation with farmers, Government Departments and municipal bodies to achieve its aim of the prevention and mitigation of soil erosion.

Agriculture in the Next Quarter Century

Precis of Presidential Address, March 2, 1961, by Dr. O. H. Frankel to A.C.T. Branch.

Research workers must think in terms of "futures"—what is planned today is applied 25 years hence, as it takes that length of time to get ideas to the opera-

tive stage. Agricultural research should be done against an economic background—but economists rarely think in terms of 25 years ahead. There must be a marriage between imaginative economists and agricultural research workers.

Let us look at Australia's situation 25 years hence. Population changes are predictable. There will be about 18 million people in Australia while South-east Asia's population will increase by three-quarters. Let us assume peace is maintained. We can predict that industrialization will continue, proceeding at a higher rate in Asia than in Australia. Australia will make more secondary industry goods for her own use, and import less. A greater proportion of her agricultural produce will be consumed at home. Certain commodities will find an expanding Asian export market.

How do these considerations affect agricultural research?

Obviously we can ask ourselves what chances there are of increasing agricultural production in Australia, and what new areas could be developed. Amongst the unexplored and unexploited areas, we think of North Queensland, which will be developed in terms of tropical agriculture and where beef is the best prospect. Or we think of Northern Australia, although the prospects here are still not clearly defined; it would possibly be better to invest the same money in more productive regions further south.

When we consider the big question of the moment —how to offset our dwindling export market—we need to make an inspired guess. Research men will need advice from the economist. Wool is going to be increasingly assailed, with a price decline almost certain. Alternatives that present themselves (dried and canned fruit, seed and fibre products of various agricultural and pasture plants) would fill a small place in terms of the total export market. In fact, if we try to think of export items to serve as alternatives to wool, very few can be given. Perhaps beef comes most readily to mind, but our best beef export year returned only £50 millions, equivalent to a drop in the wool price of sevenpence a pound.

There may of course be new developments that will change the whole picture. An example might be the commercial development of the process to obtain crude protein extracts from any plant material. This could come as meal, flour, or cakes. Such a development could mean a great deal in terms of food for the starving millions. So far little is known of the chemistry of leaf protein but obviously such a project should receive high priority.

Looking ahead, it is obvious we need some export products other than wool. It is high time we started looking for them. If the foundation is laid now it may be in time to meet the situation 25 years hence.

THE UNIVERSITY OF SYDNEY

CHAIR OF AGRICULTURAL BOTANY

Applications are invited for a newly established Chair in the Department of Agriculture, the Chair of Agricultural Botany. Salary will be at the rate of £4,250 per annum, plus cost of living adjustments (at present £42 p.a.). There is retirement provision under either the Sydney University Professorial Superannuation Scheme or the New South Wales State Superannuation Scheme. Under the Staff Members Housing Scheme, in cases approved by the University and its Bankers, married men may be assisted by loans to purchase a house. The Senate reserves the right to fill the Chair by invitation. A statement of conditions of appointment and information for candidates may be obtained from the undersigned, with whom applications close on 23rd August, 1961.

Sydney,
June, 1961.

M. A. Telfer,
Registrar.

THE GREEKS HAD A WORD FOR IT - - -

Παράσιτος*

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* *(Greek — one who eats beside, or at the table of another or at another's expense).*

News Items

Experimental Agriculture

The first number of the Institute's new Journal—*Australian Journal of Experimental Agriculture and Animal Husbandry* was published on May 1, 1961.

Papers in the first number are—

Lotononis bainesii, Baker—a legume for sub-tropical pastures—by W. W. Bryan.

The potassium status of some coarse textured soils of the south western region of Western Australia —by D. P. Drover.

Ability to select diet in Merino sheep fed in pens —by R. W. Moore and C. H. S. Dolling.

Classification of Australian wheat varieties based on the granularity of their wholemeal—by K. J. Symes.

A note on the relationship between the digestible dry matter and the digestible energy content of ruminant diets—by R. J. Moir.

Skin and skinfold thickness in relation to the depth of subcutaneous fat in beef cattle—by N. M. Tulloh.

Freeze dried cultures as commercial legume inoculants—by R. W. McLeod and R. J. Roughley.

Relationship between greasy fleece weight and clean fleece weight in the South Australian Merino —by G. H. Ford.

Seedling fluorescence and strain certification in subterranean clover—a reassessment—by E. G. Cuthbertson and Jean Briton.

The dependence of wheat quality tests on protein level—a comparative study of some Australian varieties—by J. V. Mullaly and H. J. Moss.

Experimental Agriculture is produced by the Institute for the Australian Agricultural Council with funds from the Departments of Agriculture in each state and from C.S.I.R.O. It will be published quarterly.

Bulk lots of Experimental Agriculture are delivered to each of the contributing organizations who will distribute the Journal to Government Departments and Institutions within their states. The subscription for members, student members and Company Associates of the Institute is £2 a year. For other persons and bodies it is £5 a year. Mr. J. A. Roberts, Executive Officer of the Institute, is the Business Manager.

Conference on Seed Certification and Varietal Registration

This conference was convened by C.S.I.R.O. on behalf of the Australian Agricultural Council. It was held in Melbourne from 1st to 5th May 1961 and was attended by delegates from all State Departments of Agriculture, C.S.I.R.O., Commonwealth Departments and members of the seed trade. Two overseas visitors were present. They are Dr. D. N. Heinrichs of the Canada Department of Agriculture, and Mr. J. H. Claridge of the New Zealand Department of Agriculture.

The conference discussed various aspects of the development and release of new varieties of pasture and fodder plants, varietal registration and seed certification.

Farm Policy

The second number of Farm Policy contains the following articles:

Reserve Prices and the Present Low Price of Wool, by F. H. Gruen;

Marketing and Promotion of Wool, by F. E. Hitchins, O.B.E.;

Export Potential of Western Australia's Agriculture, by H. P. Schapper;

The Low Income Farm Problem, by D. P. Fischer;

The Recommendations of the Dairy Industry Committee of Enquiry, by M. L. Parker.

"Farm Policy" is prepared by the agricultural economics group at the University of Western Australia, Nedlands, W.A.

New Director for Victoria

Mr. F. M. Read, Deputy Director since 1955, was appointed Director of Agriculture on May 6, 1961.

On joining the Department of Agriculture after his graduation as Bachelor of Agricultural Science in 1925, Mr. Read became one of the State's earliest agricultural scientists and was Australia's first horticultural scientist.

As Senior Inspector of Horticulture and later Superintendent of Horticulture, he was associated

closely with great improvements in the State's horticulture, and he set the pattern for fruit fly control which is protecting Victoria successfully from this pest.

Mr. Read is Chairman of the Trustees of the Institute of Applied Science of Victoria, has been Deputy Chairman of the Dried Fruits Board since 1934, and is a Past President of the Victorian Branch of the Australian Institute of Agricultural Science.

Potash Consumption — Australia

Crops, 1960

	Tons
Fruit (Temperate)	5,011
Fruit (Tropical)	3,572
Vegetables	4,369
Potatoes	3,049
Sugarcane	14,820
Tobacco	2,390
Pastures	16,600
Gardens	767
Minor Crops and Industrial Usage	1,141
Totals:	51,719

States, 1960

	Tons	*Per cent.*
New South Wales	3,419	6.6
Victoria	16,518	31.9
Queensland	21,053	40.7
South Australia	1,470	2.9
Western Australia	5,982	11.6
Tasmania	3,277	6.3
Australia	51,719	100

Rising Muriate consumption by pastures in Victoria and sugar cane in Queensland increased these States' shares of total usage at expense of all other States but Western Australia. Pastures still lead sugar cane in potash consumption.

Potash Consumption, 1935-1960

	Tons K_2O
1935-1939 (annual average)	5,785
1946-1949 (annual average)	6,291
1950	7,692
1951	6,457
1952	9,592
1953	11,886
1954	13,866
1955	15,722
1956	19,031
1957	23,291
1958	26,106
1959	27,403
1960	30,228

C.S.I.R.O. Meets in Perth

The executive of C.S.I.R.O. met in Perth for the first time in many years recently. While in Perth the Executive visited the various agricultural institutions, and the C.S.I.R.O. field station at Kojonup, as well as inspecting industrial developments in Western Australia. Chairman Dr. F. W. G. White said that C.S.I.R.O. research staff in this State would be increased when the planned new laboratories to be built in the University grounds were completed.

Anti-fungal Research

C.S.I.R.O. Division of Plant Industry has entered into an agreement with Fison's Pest Control Ltd. of the United Kingdom and J. R. Geigy S.A. of Switzerland for a research program in developing the new class of anti-fungal materials recently discovered by that Division. The companies will provide £18,500 per annum and other assistance in the research program over the next three years.

C.S.I.R.O. Division of Plant Industry is in receipt of a grant to be spread over 2 years and totalling 6,200 dollars from the International Atomic Energy Agency, Vienna. This grant has enabled the immediate appointment of an experimental officer to work with Dr. J. V. Possingham on the factors influencing the movement of strontium-90 from soils to plants.

Research Grant

The Nuffield Foundation has made a grant of £1,900 per annum for two years to Professor *R. K. Morton, Department of Agricultural Chemistry,* University of Adelaide, for a project concerned with the structure and biological properties of a homogeneous deoxyribonucleic acid.

Deoxyribonucleic acid is the material which carries the genetic chraracteristics of all cells. The chemical basis of this inheritance of cell characteristics is not fully understood, but it may lie in the way in which the component parts of deoxyribonucleic acid are arranged. As yet it has not been possible to determine the sequence of the nucleotides in naturally-occurring deoxyribonucleic acid, since no homogeneous material has been available. Professor Morton's work will be concerned with the determination

of the sequence in a homogeneous deoxyribonucleic acid which he has succeeded in isolating from baker's yeast because of its unique association with an enzyme called lactate dehydrogenase. The work will involve enzymic and chemical attack upon the isolated deoxyribonucleic acid. The studies will also be carried out to determine the biological role of this deoxyribonucleic acid in yeast.

International Horticultural Congress

The 16th International Horticultural Congress will be held in Brussels, Belgium, from August 31st till September 8th 1962. It is interesting to note that the First International Horticultural Congress was also held in Brussels, in April 1864, being organized in connection with the Universal Horticultural Exhibition.

The general secretary of the First Congress was Edouard Morren, professor of botany at the University of Liège and well-known editor of "La Belgique Horticole", a remarkable 19th century journal on gardens, glasshouses and orchards. The 1864 Conference brought together a large number of horticultural experts, mainly botanists, among them, Dr. Von Siebold, the famous explorer of Japan.

The Brussels Congress is being organized under the auspices of the International Society for Horticultural Science, which was founded in April 1959 and which has taken over the activities of the International Committee for Horticultural Congresses set up early this century with the object of organising International horticultural congresses at regular intervals.

The Congress Secretariat is located at the State Agricultural College, Coupure links, 235, Ghent, where all further information can be obtained.

Conference on N.T. Problems

Cattle Production

Mr. J. H. Whittem, Director of Animal Industry in the Northern Territory Administration in Darwin, addressing a scientific conference which was discussing further research into the problems of the Territory said that no significant increase in the cattle population in the Alice Springs district is expected in the near future. But, over the next ten years, planned research and development could lead to a doubling in the turn-off. Better transport, more watering points and the holding of country in reserve for drought periods are some of the requirements if this increase is to be achieved. More of the cattle turned off would be yearlings and/or weaner stores for fattening on improved pastures in the south.

Cattle production in the Barkly Tableland region is likely to increase considerably. Better husbandry, control of pleuropneumonia and other diseases, strategic control of cattle tick and lack of shade are some of the main barriers to be overcome.

Dr. M. J. T. Norman of C.S.I.R.O. reported on experiments at Katherine which showed that locally bred cattle lost over 20 per cent of their live weight during the dry season. In the wet season they gained weight rapidly but the overall annual increase in weight was only a little over 100 lb. On the other hand, cattle grazed on the native pastures and a protein concentrate gained weight during the dry season. This pointed to the need for locally grown improved pastures and crops which could overcome the nutritional deficiencies of the native pastures during each dry season.

Improved pastures of Birdwood grass and Townsville lucerne could be used to fatten cattle during the dry season. Silage from bulrush millet and sorghum grain could also be used, but less effectively.

Reports of the experiments by C.S.I.R.O. and the Northern Territory Administration showed that peanuts could be grown very well over a large area of land near Katherine. Economists at the conference doubted prospects for peanut production in the face of falling prices on the world market. Others stated that while these forecasts could not be denied, the value of peanut meal as a high protein supplement for cattle was of major importance. *Mr. C. S. Christian* of C.S.I.R.O. pointed to the value a subsidy on peanut production could have on the establishment of a cattle fattening industry in the region.

Rice Growing

"I can well understand the enthusiasm for growing rice in the Northern Territory," said *Dr. F. W. G. White,* Chairman of C.S.I.R.O.

"This vast area suggests great possibilities for future development".

Discussing the coastal plains east of Darwin, *Mr. W. Curteis,* Director of Agriculture in the Northern Territory, told the conference that a more suitable tract of land for mechanical rice growing would be difficult to find anywhere in the world, especially as it is so close to a deep water port.

Mr. Curteis admitted that the rice industry, which is in its infancy at present, faced economic problems.

However, more efficient production methods and high yields of better quality grain offered more hopeful prospects for the future.

During the course of the conference, scientists inspected research plots at the C.S.I.R.O. Coastal Plains Research Station. They saw small areas of new varieties of rice, some of which will do well under the conditions found on the coastal plains. According to *Mr. E. C. B. Langfield,* Plant Breeder at the C.S.I.R.O. Station, Sufficient quantities of the new varieties should be available for commercial production in two years time.

In suggesting that agriculture in this area could develop as a combination of rice and beef cattle, Mr. Curteis said that cattle might be grazed on the heavy clays of the rice country during the dry season. As the wet season began, they would have to be moved to the adjacent higher land, and after the rice had been harvested they could be moved back early in the following dry season. An attempt is being made to find pasture plants which will improve the carrying capacity of this land, although the volunteer forage growing in the rice bays has been found to suit cattle.

The Northern Territory Administration has shown that Para grass will grow well on the rice country. It may grow too well and become a weed in subsequent rice crops, and it is not yet possible to recommend that both be used on the same land. Sorghum almum or Columbus grass are also showing promise.

Scientists at the conference were surprised at the rapid spread of Townsville lucerne through the higher rainfall areas of the Territory. This optimism was expressed by *Mr. G. A. Stewart,* Chief of C.S.I.R.O.'s Division of Land Research and Regional Survey, who said "We have been looking for years for an equivalent to subterranean clover for the Northern Territory. Now we have it in Townsville lucerne. It grows well on the higher grounds near the coastal plains".

Bureau Announces New Plans for Wool Men

The Australian Wool Bureau will ask growers throughout the Commonwealth to increase their wool promotions levy to 10/- a bale for the next two years from July 1.

The present levy is 5/- a bale with an additional 2/- a bale for research. The Bureau's recommendation to double the promotion levy for 1961-62 and 1962-63 would bring the grower contribution to 12/- a bale, including the 2/- research levy.

The Bureau will also place a plan before Australian growers seeking additional increases in the promotion levy each year for four years, from July, 1963.

The increased levy will help expand the activities of the International Wool Secretariat which will need funds from South Africa, New Zealand and Australia to carry research and promotion into the wool buying countries of the world. There is no immediate likelihood, however, of an increase in the money to be spent on promotion within Australia.

The following table illustrates how the planned expansion in I.W.S. expenditure will be financed:—

LEVY REQUIRED TO FINANCE THE PLANNED EXPANSION IN INTERNATIONAL WOOL SECRETARIAT EXPENDITURE

1. Year	2. I.W.S. Expenditure (£stg).	3. Total Bureau Expenditure (£A).	4. Levy required incl. research	5. Levy income for research (£A)	6. Levy income for promotion (£A)	7. Other income for promotion (£A)	8. Reserves at end of year (£A)
1961-62	3,000,000	2,882,000	12/–	480,000	2,400,000	450,000	2,968,000
1962-63	3,748,000	3,464,000	12/–	500,000	2,500,000	450,000	2,454,000
1963-64	4,231,000	3,839,000	16/–	500,000	3,500,000	420,000	2,533,000
1964-65	4,730,000	4,230,000	17/6	500,000	3,875,000	420,000	2,600,000
1965-66	5,250,000	4,635,000	18/6	500,000	4,125,000	430,000	2,520,000
1966-67	5,628,000	4,925,000	20/–	500,000	4,500,000	425,000	2,520,000

Explanations:

- Figures are based on a 4.8 million bale clip for 61-62 and afterwards at 5 million bales.
- Column 3 represents not only Australia's 62% share of the I.W.S. Budget but also local expenditure on Promotion and administration in Australia.
- Column 5 shows the amount of **growers levy** going to research. The Government contributes a further 4/- per bale for research. These funds are administered by Wool Research Committee.
- Column 7 includes the current net income from Wool Stores and interest on invested reserves.
- Column 8 shows the position of reserves at the end of each year.

Federal President for 1961

Mr. C. S. Christian

Mr. C. S. Christian, Member of the C.S.I.R.O. Executive, has been elected President of the Australian Institute of Agricultural Science for 1961.

Mr. Christian graduated B.Agr.Sc. from the University of Queensland in 1929 and M.S. from the University of Minnesota, U.S.A. in 1932.

He joined the C.S.I.R. Division of Plant Industry in 1933 and was appointed Second in Charge, Agrostology Section in 1943. From 1946 to 1959 he was in charge of C.S.I.R.O. investigations on land use in Northern Australia, and immediately prior to his appointment to the Executive, he was Chief, Division of Land Research and Regional Survey.

Other positions held by Mr. Christian include: President of the Queensland Branch, A.I.A.S. (1940); President of the A.C.T. Branch (1952-3); Vice Chairman International Rice Commission (1956 and 1958); and at present he is Australian Arid Zone Research Liaison Officer.

Australian Medal of Agricultural Science

Award for 1961

Mr. C. S. Christian

The award to Mr. Christian has been made in recognition of his outstanding contribution to agriculture through his leadership and personal contribution in connection with the assessment of land potential over huge areas of virtually unknown country in northern Australia and New Guinea.

In 1946, Mr. Christian was confronted with the task of developing survey techniques which would cope with large areas of country quickly and cheaply. His "land survey" approach leading to a classification of country in terms of land systems and land units is now well known and is being put into practice overseas. To date, over 600,000 sq. miles of Australia and New Guinea have been covered.

Following the surveys he saw that for any real benefit a closer study should be made of certain type areas. His crusading for the agronomic research in type areas led to the formation of research stations at Katherine, the Ord River, Alice Springs and Darwin. He has retained close control of the research programmes at each station and a stage has been reached where this enthusiasm and leadership have stimulated commercial development. For instance, an irrigation area on the Ord River is now being established and work is in progress at present, which may well lead to closer land settlement in the Northern Territory.

Overseas commercial groups are showing interest and northern Australia may well become as Mr. Christian puts it "a new economic unit" adding to Australia's national income.

Personal Notes

Retirement of Mr. Ryan

Mr. Patrick Ryan, B.Agr.Sc., graduated from Melbourne University in 1918. He was immediately appointed Secretary of the Commonwealth Flax Committee, which had been formed during the war to encourage flax production in Australia.

In 1924 he became Farm Manager and Lecturer in Agriculture at the Queensland Agricultural College, Gatton.

Transferring to the Victorian Department of Agriculture in 1926, Mr. Ryan became Inspector of Agriculture, and was mainly responsible for experimental work on maize and summer fodder crops. In 1933 he was appointed Chief Inspector of Agriculture to assist the Director in Departmental administration. In this capacity he was largely responsible for the preparation of legislation affecting primary industries in Victoria, and he became a recognised authority on marketing legislation.

Keenly interested in administration, he played a leading part in the formation and growth of the Victorian Branch of the Royal Institute of Public Administration, of which he was President in 1954 and 1955 and a Council member for many years.

In 1955 Mr. Ryan was appointed Director of Agriculture. He retired on 5th May of this year.

During his period as Director, more than £1,000,000 has been invested in capital improvements to the various Research Stations and Colleges administered by the Department. Research facilities have been constantly improved and the scientific staff has increased from 168 to 222 during this period.

In 1959 Mr. Ryan attended a meeting of the Food and Agriculture Organisation of the United Nations as a member of the Australian delegation.

Mr. Ryan has served on many Federal and State organisations. He was a member of the Council of the University of Melbourne and of the Advisory Council and Victorian State Committee of C.S.I.R.O. He served on the State Land Utilisation Advisory Council and the Australian Standing Committee on Agriculture. Until recently, Mr. Ryan represented the Australian Agricultural Council on the Dairy Produce Research Committee, and was the Council's Adviser on the Wool Research Committee.

Australian Capital Territories

Sir John Crawford, who resigned as Secretary of the Commonwealth Department of Trade in June last year, recently returned to Australia after some months in the U.S.A. He has now taken up his position as Director of the Research School of Pacific Studies and Professor of Economics at the Australian National University. Whilst in U.S.A. he visited a number of Universities in preparation for his new appointment.

Dr. B. R. Davidson, formerly of the Victorian Branch, has transferred to C.S.I.R.O. Division of Land Research and Regional Survey after some years in Kenya and the United Kingdom. He is currently adding a touch of agricultural economics to a survey by that Division of the Hunter Valley.

Mr. C. G. Greenham of C.S.I.R.O. Division of Plant Industry will leave shortly for a stay of almost twelve months at University of California. He will study translocation in the mistletoe, under a grant from the American National Science Foundation.

Mr. F. H. Gruen, Senior Research Fellow in Economics at Australian National University, has been elected President of the Australian Society of Agricultural Economists for the current term.

Mr. W. Hartley, Officer-in-charge of C.S.I.R.O. Plant Introduction Section, Division of Plant Industry, will leave for a five months overseas trip on June 16. He will visit Pakistan and India, U.S.S.R., various European countries including Hungary and East Germany, and the U.S.A. Besides discussing plant introduction matters, he will attend the FAO Technical Meeting on Plant Exploration and Introduction to be held at Rome in July.

Mr. J. W. Van Holst Pellekaan of Bureau of Agricultural Economics has been granted a full time free place at University of New England by the Commonwealth Public Service Board. He will undertake post-graduate study in agricultural economics and in policy and production economics.

Dr. J. V. Possingham of C.S.I.R.O. Division of Plant Industry has been invited to attend the Tenth Pacific Science Congress, Honolulu, next August. He will present a paper on the application of radio-isotopes to agriculture.

Dr. R. F. Williams of C.S.I.R.O. Division of Plant Industry is at present overseas on a five months

overseas tour. He will discuss latest developments in research in the field of plant physiology at leading institutions in India, U.S.S.R., Europe, United Kingdom, U.S.A., and Japan.

Dr. F. H. W. Morley has been appointed head of the Grasslands Agronomy Section of Division of Plant Industry. This group will continue and expand the studies in plant-animal relationships previously conducted under the title of Pasture Utilization Investigations by W. M. Willoughby, now transferred to Division of Animal Physiology at Armidale.

Papua and New Guinea

Mr. G. K. Graham who is the Principal Soil Survey Officer with the TPNG Department, was the branch delegate at the Council in Person meeting of the Institute at Melbourne in March.

Mr. G. P. Keleny has departed for six months leave in England. During his absence *Mr. C. C. Martin,* a recent graduate from Queensland, will be carrying out the duties of Plant Introduction Officer with the TPNG Department at Port Moresby.

Miss Peggy Thorne, formerly of the C.S.I.R.O. Cunningham Laboratories in Brisbane has taken up duties as Chemist with the TPNG Department in Port Moresby.

Mr. A. C. Hartley is undertaking a post graduate course in tropical agriculture at the Imperial College of Tropical Agriculture, Trinidad. *Mr. W. R. Stent* who has recently completed the course will soon be returning to the Territory following a post-study tour of Africa and recreation leave in Australia.

Mr. S. S. Doumany has resigned from the T.P.N.G. Department of Agriculture to take up duties as Agricultural Economist with the Queensland Department.

Dr. J. J. H. Szent-Ivany will be attending the 1961 ANZAAS Conference in Brisbane.

Tasmania

Mr. B. D. Frappell, who was formerly stationed in Hobart, is now working in the North of the state with headquarters at Launceston. His work is concerned mainly with the canning pea industry but also covers other commercially important vegetable crops.

Mr. M. J. Fisher has recently moved from Launceston to Wynyard where he will continue his pasture investigational work in the North West Coast region.

Mr. G. R. Johnstone, recently graduated from Melbourne, has taken up an appointment with the Tasmanian Department of Agriculture as a plant pathologist and is working principally with virus diseases of pome fruits.

Victoria

Dr. D. E. Tribe of the School of Agriculture left Australia in May for a year's subbatical leave. Dr. Tribe will visit universities and agricultural research institutions in the United Kingdom and South Africa.

Mr. C. E. Cole, Superintendent of Horticulture, Department of Agriculture, also left in May for a five month tour of horticultural investigation. He will visit horticultural institutions in the United Kingdom and U.S.A.

Mr. B. Cockcroft of the Tatura Horticultural Research Station has filled the long standing vacancy of Senior Irrigation Officer in the Horticulture Division of the Department of Agriculture.

In the Department of Agriculture's third annual Random Sample Laying Test, the entry of *Mr. A. G. Edmonds* was placed equal first. Mr. Edmond's entries won the previous two tests.

Western Australia

Mr. W. Langby, formerly technical adviser on agricultural chemicals to Westralian Farmers Co-operative Ltd., has been appointed Officer in Charge of the organisation's agricultural chemicals section.

Mr. A. Egan has left the Department of Agriculture to take up a research studentship at the University Institute of Agriculture. He will investigate appetence in ruminants.

Mr. G. Olney of the Department of Agriculture, is spending a year at the University of Sydney, where he hopes to obtain the university's Diploma of Animal Husbandry.

Mr. A. B. Beck has returned from the Argentine to the C.S.I.R.O. Division of Plant Industry.
Mr. A. L. Chapman, from the Kimberley Research Station, is at the moment in Davis, California.

Mr. L. J. Durham, formerly of the Victorian branch, has joined the West Australian accountancy firm of C. P. Bird and Associates, where he will start a new farm management service for the firm's clients.

Dr. H. P. Schapper and *Mr. D. Treloar* of the University Institute of Agriculture spent three weeks of the May vacation in the Kimberleys, doing ground work for a proposed project on the potential for economic growth in the North-West and Kimberley areas of Western Australia.

Dr. Schapper is now producing Western Australia's first agricultural television show, a weekly programme run by the local commercial station.

Mr. E. Lawson has left The Countryman to take up the position of Publications Officer in the Department of Agriculture.

Professor E. J. Underwood has almost completed preparation of the second edition of his successful book "Trace Elements in Human and Animal Nutrition".

Mr. J. Lawson has left the North-West branch of the Department of Agriculture to become agricultural writer on The Countryman magazine.

Branch Notes

Papua and New Guinea

The by-laws of the branch have been drawn up and were presented for notification by members at the first Annual General Meeting held in March. Particular attention has been given to assuring full membership privileges for those people who cannot regularly attend meetings due to isolation from main centres.

The membership drive has been particularly successful and there are now over 40 graduates on the list of members. This represents a considerable proportion of potential members available in the Territory.

An editorial committee has been set up and it is proposed to circulate at least quarterly, a newsletter in which members will be kept informed of institute matters and research projects which may be of interest. It is felt that the newsletter will be a very important part of Institute affairs in the Territory.

South Australia

At the annual general meeting of the South Australian branch on February 3 the following office bearers were elected:

President: Dr. K. W. Finlay
Vice-President: Mr. J. C. M. Fornachon
President-elect: Mr. T. C. Miller
Hon. Secretary: Mr. E. W. Boehm
Hon. Asst. Secretary: Mr. P. McK. Barrow.
Hon. Treasurer: Dr. B. G. Coombe
Hon. Sub. Editor: Mr. M. J. Mathison
Committee Members: Mr. J. V. Mertin, Mr. W. J. Moller, Mr. K. H. Northcote.
Hon. Auditors: Mr. M. B. Spurling, Mr. K. M. Cellier.

Tasmania

At the Annual General Meeting, February 24, the following office bearers were elected.

President: Mr. D. Berry
President-elect: Mr. B. C. Jefferies
Vice-President: Mr. P. J. Fountain
Secretary: Mr. W. M. Blacklow
Assistant Secretary: Mr. B. Thistlethwayte
Treasurer: Mr. A. M. Graley
Journal Sub-Editor: Mr. I. D. Geard
Committeemen: Mr. G. M. Dimmock, Mr. A. G. L. Wilson.
The Immediate Past President is Mr. S. M. Sykes.

Victoria

The Twenty-sixth Annual General Meeting of the Victorian Branch of the Institute was held at the School of Agriculture on Monday, April 17.

The annual report and financial statements were adopted and the following members were elected to the committee for this year.

President (and Principal Delegate): R. S. Harper

Vice President: W. Ives

Immediate Past President: H. R. Dickinson

Hon. Secretary: C. D. Kimpton

Hon. Assistant Secretary: T. W. Donaldson

Hon. Treasurer: B. C. Hanger

Hon. Assistant Treasurer: M. G. Hawson

Ordinary Members: W. P. Dunk, A. Mitchell, P. T. Jenkins, J. Wilson.

Hon. State Sub-Editor: A. S. Watson

Hon. Recorder: M. N. Kinsella

Professor of Agriculture (Ex-Officio): Prof. H. C. Forster.

Western Australia

The W.A. branch annual general meeting was held on Friday, April 21, when the following officers were elected:

President: Professor E. J. Underwood

Vice President: Mr. R. J. Moir

Secretary: Mr. E. N. Fitzpatrick

Asst. Sec.: Mr. M. D. Carroll

Treasurer: Mr. T. C. Stoneman

Journal sub-editor: Mr. E. H. Lawson

Committee: Mr. A. W. Humphries, Mr. H. Lloyd Davies, Mr. C. J. Spencer, Dr. L. C. Snook.

Retiring President N. J. Halse's presidential address was "Research into Problems of Tobacco Growing in Western Australia", an interesting account of a research project stretching over some years, which aims to solve some of the delicate problems involved in producing high quality tobacco leaf in a comparatively new and difficult environment for this plant.

Appointment of non-graduates (New Zealand diplomates) to a number of newly formed farm management clubs in Western Australia has caused some concern in this branch, and a variety of opinions have been expressed. These vary from a fear that if a trend for such appointments developed that the status of agricultural science as a profession, and employment opportunities of Institute members could be threatened to complete unconcern. Most feel that as the clubs have not been able to find suitable graduates they cannot be blamed for appointing the best men available (although they may run a risk of poor advice being given) and that graduates would be appointed if they were available. It has been decided that the Institute should co-operate as fully as possible with the Federation of Farm Clubs recently formed in this State, and the Federation has been approached to arrange a meeting to discuss problems of mutual interest—including appointment of graduate advisers in the future.

At the previous ordinary general meeting Professor E. J. Underwood gave a brief history of the Agricultural degree course at the University of W.A., and described proposed changes to the present course, which are now being worked out. The talk raised great interest at a well-attended meeting, and a long and interesting discussion followed, in which members were given a chance to make suggestions as to how the course could be improved. Most of those present felt some satisfaction that they had their course already behind them! The University is still working on details of the proposed changes.

PROCEEDINGS
of the
AUSTRALIAN SOCIETY OF ANIMAL PRODUCTION
Vol. 3 (1960)

Reporting the 34 papers delivered at the Society's THIRD Biennial Conference, Brisbane, Queensland, August 1960, are available from —

J. A. Roberts,
The Australian Institute of Agricultural Science,
226 Clarendon Street,
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at a price of £1 per copy, postage included.

(Copies of Vol. 1 (1956) and Vol. 2 (1958) are also available at the same price.)

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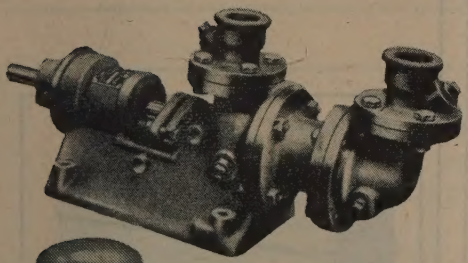

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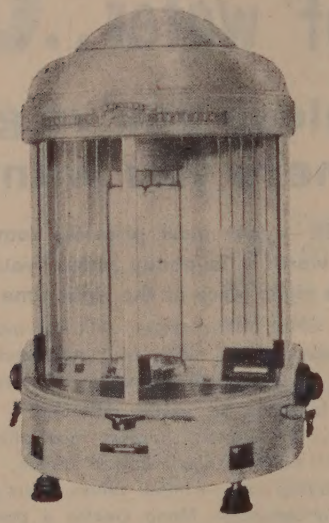

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SUGAR CANE

Australia enjoys a luxury consumption of sugar due to the high standards of production being achieved by both growers and millers. Production in 1959 was valued at over £61 million, of which more than £28 million was derived from exports.

The marked progression in recent years has been characterised by increased tonnages of cane per acre and a high sugar content in the cane. Intensive effort has been directed to research, technology and marketing; many new varieties have been produced, mechanical harvesting is well under way and, in 1959, three Queensland mills achieved a recovery of over 90 per cent—a record seldom achieved in any country. In 1947, production of sugar per acre was 2.59 tons per acre; in 1959 it was 3.44 tons.

Some 200,000 people directly dependent upon the industry are seemingly assured of their future with the increasing overseas demand for their product. Besides present markets in the U.K., Canada and, to a lesser extent, New Zealand, there is the possibility of additional markets in the U.S.A., following the break in diplomatic relations of that country with Cuba.

Sulphate of ammonia has played an important part in the growth of the sugar industry, as applied nitrogen is essential for the growth of such a vigorous crop; in fact it is difficult to grow a successful crop without it. The Bureau of Sugar Experiments Stations now invariably recommend the use of nitrogen in fertiliser mixtures for sugar cane at planting and growers know that a topdressing of 1½-4 cwts. per acre of sulphate of ammonia is also very profitable just before the crop grows out of hand.

Sulphate of ammonia is made in Australia and is distributed by all fertiliser dealers and agents.

Inserted by Nitrogen Fertilisers Pty. Ltd., 500 Bourke St., Melbourne.

ANIMAL PRODUCTION

Journal of the British Society of Animal Production

Contents of Volume 3, No. 2, June, 1961.

BELLIS, D. B. and TAYLOR, J. Nutritional Factors in lean meat production of pigs.
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